Metacognitions of Flow Experience: Towards an Understanding of the Self-Regulation of Optimal Experience

DOCTORATE OF PHILOSOPHY

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Publications and Conference Presentations

Study 1

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Study 2 and Study 3

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Abstract

Flow has been described as a state of cognitive efficiency and intrinsic enjoyment, whereby a person feels at one with the activity. The existence of an autotelic personality', an inter-individual difference dimension characterised by the propensity with which a person experiences flow, has been proposed, but the construct has proven to be relatively elusive. The overall aim of this PhD dissertation was to advance flow theory, and in particular enhance the knowledge of individual differences in flow experiences by the investigation of a new construct, flow metacognitions. Flow metacognitions were defined as people's metacognitive knowledge and beliefs on flow as a state of optimal cognitive functioning. Building upon the concepts of adaptive and maladaptive metacognitions (Beer & Moneta, 2010; Wells, 2000) that were found to impact self-regulation efforts during demanding situations, it was postulated that people would also hold metacognitions on flow, a cognitive state of deep absorption usually elicited by a demanding activity. However, to date, flow metacognitions had not been defined, measured, or tested for their relevance in the context of flow experiences (or in other contexts of optimal experience). This dissertation presents four studies that were conducted to identify flow metacognitions, comprising the development and validation of a self-report questionnaire to measure them validly and reliably, as well as the examination of the scientific relevance of the operationalised constructs.

Preliminary instances of potential flow metacognitions were identified in qualitative analyses, whereby the qualitative content of Flow Questionnaires (FQ, Csikszentmihalyi & Csikszentmihalyi, 1988) administered to a sample of 371 workers was analysed. In addition, semi-structured interviews with 12 workers were

held about their experiences of flow in work (Study 1, Chapter 2). From these analyses, two broad metacognitions emerged: people's beliefs in the 'usefulness' of being in flow, and individual differences in their beliefs and confidence in the self-regulation of flow experiences. Based on the metacognitive constructs identified in the qualitative analyses, a 53-item pilot Flow Metacognitions Questionnaire (FMQ) was developed and tested on a sample of 204 UK students. Exploratory factor analysis yielded a two-component solution, with item reduction procedures leading to a 12-item scale. Subsequent principal component analysis on the same sample confirmed that the 12 items loaded onto two main components: Beliefs that Flow Fosters Achievement (FMQ-1) and Confidence in Ability to Self-Regulate Flow (FMQ-2). The subscales explained a total of 52.4% of the variance; 28.3% for FMQ-1; and 24.1% for FMQ-2 (Study 2, Chapter 4). Confirmatory factor analysis performed on the data of a sample of 159 workers supported the two subscales of the final 12-item FMQ.

After gathering evidence of the construct validity, the FMQ was used to test the impact of flow metacognitions on the frequency (measured by the FQ), and the intensity of people's flow experiences, as measured by three well-established flow scales (the Short Dispositional Flow Scale-2, Jackson, Martin, & Eklund, 2008; the Flow Short Scale; Rheinberg, Vollmeyer, & Engeser, 2003; and the Short Flow in Work Scale, Moneta, 2012a). Flow was measured as a general disposition in the context of work. Analyses controlled for maladaptive metacognitions (Meta-Cognitions Questionnaire, Wells & Cartwright-Hatton, 2004), and adaptive metacognitions (Positive Metacognitions and Meta-Emotions Questionnaire, Beer & Moneta, 2010). Confidence in Ability to Self-Regulate Flow (FMQ-2) was found to be a significant predictor of the intensity and frequency of flow experiences in work,

and outperformed established measures of flow, adaptive, and maladaptive metacognition. The results indicated a positive relationship between people's confidence in self-regulating flow experiences and work-flow. Interestingly, people's beliefs about the positive consequences of flow in terms of achievement did not predict flow in work (Study 3, Chapter 5). These findings supported the predictive and concurrent validity of the FMQ-2.

Building upon these correlational findings, a longitudinal study was conducted in order to identify potential causal mechanisms between flow metacognitions and flow at work. A sample of 101 professionals took part in a two-wave longitudinal study by completing the FMQ and the three flow scales used in Study 3, measuring the experience of flow as a domain specific trait in the context of work. A series of structural equation models (SEM) supported a longitudinal causal relationship between FMQ-2 and flow. For FMQ-1, this relationship was not found (Study 4, Chapter 6).

Overall, the findings from the four studies conducted in this dissertation indicate that the FMQ-2 could be conceptualised as an antecedent of flow and a marker of the autotelic personality, because it was found to causally influence people's experience of flow in the work context. The dissertation concludes with an outline of its limitations as well as an outlook for future research. In particular, avenues for gaining a more in-depth understanding of the underlying processes with which flow metacognitions might influence the experience of flow, e.g. by investigating moment-to-moment variations of flow as a state, are given.

It is believed that this PhD dissertation has met its aims by having identified a new and important construct that was found to be positively associated with flow

as well as adaptive metacognitions. Furthermore, it has provided a starting point for future programmes of research – both in terms of flow and adaptive metacognitions, as well as applications in achievement contexts, in particular work environments.

Chapter 1: Introduction

1.1 Historical Context of Flow Research

Flow has been described as 'a peculiar state of experience', a state of deep absorption and intrinsic enjoyment in an activity (Csikszentmihalyi, 2000, p. 35). The initial description of the flow state dates back to the 1970s, when Mihaly Csikszentmihalyi set out to unravel the apparent paradox of why people would put huge efforts into activities which reaped no or little tangible rewards.[1] People would describe a 'flowing', or 'being in the zone' when they were fully engaged in the activity and things went smoothly. Based on interview accounts, Csikszentmihalyi discovered communalities between the optimal experiences described by learners and experts in a range of disciplines, including rock climbing, chess playing, composing, and sports. Since its inception, an increasingly growing body of systematic academic research, in addition to bestselling books aimed at the wider public (e.g. Csikszentmihalyi, 1990, 1994, 1997), has been contributing to the evidence base on flow. The initial notion that flow was essentially a universally recognised subjective experience has been confirmed by a plethora of research with diverse samples such as blind nuns, former drug addicts, people from alpine communities, professional surfers, and students of various disciplines (Massimini, Csikszentmihalyi, & Delle Fave, 1988), both in leisure contexts and competitive ones such as work, study, or elite sports (Cermakova, Moneta, & Spada, 2010; Fullagar & Kelloway, 2013; Jackson, 1992). Furthermore, the movement of positive psychology, initiated at the turn of the millennium by the then president of the

[1] A seminal work is Csikszentmihalyi's *Beyond boredom and anxiety: experiencing flow in work and play*. San Francisco: Jossey-Bass, first published in 1975. The 2000 edition of the work is cited throughout this dissertation.

American Psychological Society, Martin Seligman, provided an 'umbrella' for a range of existing and subsequently evolving theories and concepts on optimal human functioning, with flow playing an integral part (Seligman & Csikszentmihalyi, 2000). Furthermore, flow as a concept has been found both scientifically and intuitively meaningful (Engeser & Schiepe-Tiska, 2012) and has established itself firmly as a core construct within the eudemonic approach to optimal functioning.

1.2 Prevalence and Frequency of Flow

Even though the concept of flow appears to be widely recognised, there has been disagreement as to the frequency with which flow is experienced. While some commented on it as being a 'relatively rare experience, difficult to encounter every day' (Massimini & Carli, 1988, p. 266) others pointed out that flow could be experienced frequently and in everyday work and leisure activities (e.g. Graef, 2000). A range of studies attempted to quantify the frequency with which flow was experienced and suggested that broadly two-thirds of people were flow-ers (i.e. experienced flow), whereas about one third did either not experience or recognise instances of flow in their lives (i.e. non-flow-ers) (e.g. Moneta, 2012b, 2014). For example, Asakawa (2010) found in a sample of Japanese students that 27% never experienced flow, with only 1.3% experiencing it daily and over 90% less than once per week. These figures were compared to Western samples where 42% and 35% (in an American and German sample respectively) did not experience flow (Gallup Poll, 1998; Noelle-Neumann, 1995). However, Western flow-ers experienced flow more frequently compared to the Asian sample, with 18% of Americans and 23% of Germans experiencing flow daily. Some studies reported an even higher prevalence of flow, e.g. Massimini et al. (1988) reported a frequency of 97% to 100% of Italian student and community samples experiencing flow, although it should be noted that

some of the sample sizes used were relatively small. Different ways of measuring the frequency of flow may also have led to results which were not directly comparable. In addition, cultural, gender, and age differences, and other factors of the samples' compositions may contribute to differences in the prevalence and frequency of flow. Furthermore, Moneta (2014) pointed at the possibility of major historical events influencing the prevalence of flow. Based on a large sample of British professionals, with data on flow prevalence captured by the Flow Questionnaire (FQ, Csikszentmihalyi & Csikszentmihalyi, 1988), it was reported that flow was commonly experienced, but was found more regularly in leisure contexts than in work. Most importantly, the data were collected after the onset of the recession in 2008, which led to the conclusion that 'flow is common, but not easy to achieve in work, at least in the current historical juncture' (Moneta, 2014, p. 186). Interestingly, parallels between this initial evidence of a reduction of flow in work and an increase in mental health problems among workers could (tentatively) be drawn. Modrek, Hamad, and Cullen (2015) found that workers who had been continuously employed during the 2008/09 recession increased their use of mental health services as well as mental health related medication.

1.3 Components of Flow

Flow as a subjective optimal experience was described as a multidimensional construct that included a range of components. These components were built upon, based on the analyses of interviews Csikszentmihalyi and co-workers held with a range of intrinsically motivated individuals, from an initial six to a total of nine[2]

[2] The components which were added later were the transformation of time, as well as people's perception of the balance between challenges and skills. Unambiguous feedback and non-contradictory demands were previously combined in one component but subsequently reported separately (Engeser & Schiepe-Tiska, 2012).

(Csikszentmihalyi, 2000; Csikszentmihalyi, 2002; Csikszentmihalyi & Csikszentmihalyi, 1988). These components were described as follows, with experiential quotes based on interviews by Csikszentmihalyi (2000) and Jackson and Csikszentmihalyi (1999) given in parentheses: (1) merging of action and awareness (e.g. 'You don't see yourself as separate from what you are doing', p. 39); (2) centred attention on a limited stimulus field, enabling the merging of action and awareness (e.g. 'When I start working, I really do shut out the world', p. 41) ; (3) loss of self-consciousness (e.g. 'You become a robot – no, more like an animal' p. 43); (4) control over actions and environment (e.g. 'I get a tyrannical sense of power. I feel immensely strong', p. 44); (5) unambiguous feedback on one's actions (e.g. referring to rock climbing: 'I think it's one of the few sorts of activities in which you don't feel you have all sorts of different kinds of demands, often conflicting upon you', p. 46) (6) autotelic, intrinsically rewarding nature of the experience (e.g. 'The mystique of rock climbing is climbing; you get to the top of a rock glad it's over but really wish it would go forever', Csikszentmihalyi, 2000, p. 47); (7) balance between challenges and skills (e.g. 'Challenging but being able to meet the challenges', p. 16), (8) clarity of goals (e.g. 'I knew exactly how I was going to swim the race', p. 21), and (9) loss of time awareness (e.g. 'For sixteen and a half hours I was in it [flow] basically. If you ask me, did that feel like sixteen and a half hours? I'd say it felt like about three hours', Jackson & Csikszentmihalyi, 1999, p. 29). These characteristics were corroborated with a variety of samples that carried out a wide range of activities (e.g. Csikszentmihalyi, 2000; Csikszentmihalyi & Csikszentmihalyi, 1988). Nevertheless, despite the consistency with which people were able to give narrative accounts of their flow experiences, the number of flow components has been debated (e.g. Swann, Keegan, Piggott, & Crust, 2012). In

particular, flow research has been divided when it has come to the inclusion of the autotelic experience as a separate component, as it could be considered a description of the flow state itself and therefore inclusion would be superfluous. Swann et al. (2012) commented that the autotelic experience was predominantly included in flow research in sports, while in other domains it was omitted. Researchers have also called for a better understanding of the psychosocial aspects and mechanisms underlying flow, either by association or causation (e.g. Kimiecik & Stein, 1992; Swann et al., 2012).

1.4 Measuring Flow

Despite researchers having knowledge of the components underlying flow, the operationalisation of flow as a construct that could be captured qualitatively as well as quantitatively has been challenging (Moneta, 2012b). An overview of the conceptualisation and measurement of flow by Hoffman and Novak (2009), though focusing only on flow research related to online environments, highlighted a divergence in the field. Hoffman and Novak cautioned that 'such a wide range of operational definitions and measures may have had the unfortunate consequence of hindering the systematic progression of empirical research on flow' (Hoffman & Novak, 2009, p. 26). The range of measures that were developed fell into four broad methodological groups: semi-structured interviews, the experience sampling methodology, experimental approaches, and questionnaire measures. *Semi-structured interviews* were used to initiate and further theory development. Interviews were primarily the method of choice in the early stages of the advancement of flow theory to gain insights into the intrinsic aspects of a range of activities, which provided the initial material from which flow theory was generated. In general, however, interviews were used less frequently than other methods.

Questionnaire measures were the most frequently used mode of gathering flow data and utilised both global and componential (i.e. multidimensional) operationalisations of flow (Hoffman & Novak, 2009, Moneta, 2012b). The Flow Questionnaire (FQ, Csikszentmihalyi & Csikszentmihalyi, 1988) measured flow based on three related quotes of characteristics of flow, asking participants if they recognised this experience in their daily lives. Participants would answer either yes or no. If people recognised the descriptions, they were further asked to specify in which activities they had been engaged. The quotes, derived by Csikszentmihalyi, were described as follows by Han (1988):

1. My mind isn't wandering. I am not thinking of something else. I am totally involved in what I am doing. My body feels good. I don't seem to hear anything. The world seems to be cut off from me. I am less aware of myself and my problems.

2. My concentration is like breathing. I never think of it. I am really quite oblivious to my surroundings after I really get going. I think that the phone could ring, and the doorbell could ring or the house burn down or something like that. When I start, I really do shut out the whole world. Once I stop, I can let it back in again.
3. I am so involved in what I am doing. I don't see myself as separate from what I am doing. (Han, 1988, pp. 139–140)

The advantages of the FQ were threefold (Moneta, 2014). First, it gave definitions that captured the three main components of the flow experience (i.e. loss of self-consciousness; centring of attention; and merging of action and awareness), which had to be simultaneously present in order to constitute the experience of flow (Engeser & Schiepe-Tiska, 2012; Moneta, 2012a, 2012b). Second, it provided an overall estimate of the number of flow-ers and non-flow-ers (i.e. the prevalence of flow in the population) and third, it also made it possible to determine the prevalence of different flow activities (Moneta, 2014). Further, its relative ease of use made it a useful research tool. One of the drawbacks of the FQ, however, could be its cross-

cultural validity in terms of predicting the prevalence of flow. For example Han (1988), using the FQ, found considerably fewer instances of flow (only 33% experiencing flow) in a sample of elderly American immigrants from Korea than would have been expected from comparable Western samples. One of the reasons quoted was that participants, although acknowledging that flow experiences might exist, might have taken the quotes such as 'the house could be burning down' presented in the questionnaire too literally. Another disadvantage of the FQ was that it was never fully validated and it did not capture all of the nine components of flow (Moneta, 2014).

Another strand of quantitative flow research, which has been well validated, applied a componential approach to the measurement of flow. Here, flow was measured based either on selected components of the flow experience (e.g. Moneta, 2012a; Schiefele & Raabe, 2011), or all of its components (e.g. Jackson & Eklund, 2002; Jackson et al., 2008; Rheinberg et al., 2003). One of the earliest questionnaires developed was the six-item Flow Scale (Jackson & Roberts, 1992), based on the initially identified six flow components for use in the domain of sports. Further dispositional as well as state measures of flow were subsequently developed by Jackson and colleagues, which included all nine components of flow (Jackson & Eklund, 2002; Jackson et al., 2008). The Flow Short Scale (FSS) developed by Rheinberg and colleagues (Rheinberg et al., 2003) measured flow based on eight components but excluded the autotelic experience as a separate component. Other questionnaire measures operationalised flow as being comprised of a sub-set of components, such as the Short Flow in Work Scale (SFWS) by Moneta (2012a), which included three components (i.e. loss of self-consciousness, centring of attention, and merging of action and awareness). Others measured flow as a

unidimensional construct based solely on the absorption component of the flow experience (Schiefele & Raabe, 2011). However, it should be noted that research indicated that flow was not equivalent to absorption, as indicated e.g. by moderate correlations between flow and attentional control (Cermakova et al., 2010). Moneta (2014) pointed out that one of the main advantages of componential approaches to quantifying flow was that the psychometric properties of the scales had been validated, which showed them to be more valid and reliable compared to other ways of assessing flow. The main disadvantage, however, was that they were described as imposing the experience of flow on all participants, with lower or higher intensity or frequency depending on their ratings of the scale, without providing a cut-off for those who experienced flow and those who did not. As research based on the FQ showed, not everyone recognised flow (Moneta, 2012b).

Nevertheless, questionnaires operationalising flow by the measurement of its underlying components also attracted criticism due to the potential confounding of the preconditions of flow with its cognitive and affective components (Hoffman & Novak, 2009). Measures which only included a small subset of the flow components were criticised for not fully capturing the inherent multidimensionality of the flow experience (Engeser, 2012; Schiefele, 2013), while it was also pointed out that some measures were 'bypassing' flow altogether by capturing related constructs, such as interactivity and exploratory behaviour, but not flow (Fullagar & Kelloway, 2013; Hoffman & Novak, 2009). In particular, the WOrk-reLated Flow scale (WOLF; Bakker, 2008), a measure of work-flow, was criticised for largely overlapping with the concept of work engagement (Fullagar & Kelloway, 2013).

Building upon the insights gathered via in-depth interviews and the FQ, the *Experience Sampling Method (ESM)* was developed by Larson and Csikszentmihalyi

(1983). The ESM was an innovative and bespoke tool for measuring people's daily experiences. Participants were usually supplied with a handheld electronic device (in earlier studies these used to be pagers or watches) that would prompt them to complete a brief questionnaire upon being signalled. Depending on the design of the ESM, signals occurred at random or fixed intervals (i.e. signal contingent) during the day or only when a person was engaged in a specific activity (i.e. event contingent) with studies having employed anywhere from two to ten signals per day (Dimotakis & Iles, 2013). ESM technology attracted some criticism, as flow was generally only operationalised based on one of its components, the challenge–skill balance, and the other components of flow were not measured. Yet, an advantage of the ESM was that it could be used to simultaneously investigate both intra- and inter-individual differences in everyday experiences (Dimotakis & Iles, 2013). It was also usefully employed as a methodology for guiding interventions in the clinical context and in the evaluation of treatment outcomes (Hektner, Schmidt, & Csikszentmihalyi, 2007; Ravenna, Hölzl, Kirchler, Palmonari, & Costarelli, 2002).

In addition to correlational analyses based on ESM data, *experimental approaches* were used only in recent years. The increase in experimental research could be attributed partly to the progress of computer technology that enabled more sophisticated experimental designs based on computerised tasks (Engeser & Rheinberg, 2008; Keller & Bless, 2007; Keller & Blomann, 2008). For example, video games such as Tetris were used, which enabled a controlled manipulation of the independent variable, most often operationalised as the balance between challenges and skills by the adjustment of the difficulty level of the game. Experimental approaches were also successfully used in understanding psychophysiological correlates underlying flow experiences (Keller, Bless, Blomann,

& Kleinböhl, 2011; Peifer, 2012; Peifer, Schulz, Schächinger, Baumann, & Antoni, 2014). Experiments were important as they ensured high internal validity, which tended to be low in correlational studies, due to the lack of direct manipulation of explanatory variables. They were also reported to be high in cognitive realism and therefore adding to their external validity (Fullagar & Kelloway, 2013).

1.5 Antecedents of Flow

Even though the identification of the components of flow had been an important step, it did not further the understanding of the antecedents[3] – the situational or psychological factors – facilitating flow. Remaining in the realm of the identified nine characteristics of flow, a relatively broad distinction was made by categorising these into three flow conducive 'preconditions' (challenge of balance and skills, goal clarity, and feedback on the performance of the task) and six 'characteristics' of flow (absorption, intrinsic motivation, control, merging of action and awareness, loss of self-consciousness, transformation of time) (Nakamura & Csikszentmihalyi, 2005; Fullagar & Kelloway, 2013). Others adopted a similar approach, e.g. Quinn (2005) categorised these dimensions into the same antecedents and characteristics (i.e. the remaining five components except for the autotelic experience) but described the autotelic experience as a consequence of flow.

Based on the three antecedents of flow research, efforts were predominantly focused on the challenge and skills balance, which could partly be explained by the historical advancement of flow theory and the use of the ESM methodology. In his seminal book, 'Beyond Boredom and Anxiety', which set the corner stone of flow theory, Csikszentmihalyi (2000) posed an important question with regard to the

[3] Antecedents have also been interchangeably described in the literature as preconditions, facilitators, or precursors of flow.

antecedents of flow: ‘How do some activities make possible the experience of flow’ (p. 49). Even though the question proposed that the antecedents of flow would lie mainly in the activity itself, the resulting first model for predicting under what circumstances flow would occur combined both social/situational and psychological factors – the challenges of the activity and the skills of the person. It was suggested that those tasks that presented opportunities for action (i.e. challenges) and that people could act upon dependent on their action capabilities (i.e. skills) without getting bored or anxious would facilitate flow (Csikszentmihalyi, 2000).

Based on these considerations the original flow model (Csikszentmihalyi, 2000) emerged, which assumed that a balance of challenges and skills, regardless of whether these were low or high (as long as these were in unison), would lead to flow. An imbalance would lead to worry or even anxiety, when challenges exceeded skills to some or a large extent. An imbalance of challenges and skills could also lead to boredom when skills exceeded one’s challenges. However, the model did not fit the data as well as expected. Therefore, based on findings from ESM research, an extended version of the initial model, the ‘quadrant model’ was introduced (Csikszentmihalyi & Csikszentmihalyi, 1988), which included an important departure from the previous model. It was found that, although the balance of challenges and skills was important, flow was only facilitated when both were relatively high (Csikszentmihalyi & Csikszentmihalyi, 1988). The quadrant model, therefore, predicted that a match between a person’s above average level of skills and above average level of challenges would lead to flow, while mismatches would result in three less desirable states, i.e. anxiety (when personal skills were low and challenges were high), boredom (when challenges were low but skills were high), and apathy (when both challenges and skills were below the personal average). This

model still exhibited a number of weaknesses. In particular, its parsimoniousness led to being over-inclusive in predicting flow. It placed a quarter of experiences into the flow quadrant, which, as pointed out in a review by Moneta (2012b), was an overestimate and had not been corroborated by results based on alternative measures such as the FQ. To overcome some of the shortcomings of the quadrant model, Massimini and Carli (1988) proposed an eight channel model, also based on the ratios between perceived challenges and skills. This model captured a wider range of eight experiential states (arousal, flow, control, relaxation, boredom, apathy, worry, and anxiety), which at the same time narrowed the proportion of experiences attributed to flow. A range of studies corroborated this model, identifying that the most optimal experiences fell into the section of the model occupied by flow. As the conceptualization of the eight channel model was to some extent arbitrary, it was suggested to test other models as well, such as a 16 channel model of flow (Massimini & Carli, 1988). Others, e.g. Clarke and Haworth (1994) adopted a nine channel model of flow by the addition of 'ease', a state of moderate challenges matched by skills, to the existing eight-factor model of Massimini and Carli (1988). Clarke and Haworth (1994) concluded that their research broadly confirmed the expanded flow model, as the flow channel was the one where most intense enjoyment and interest was reported. However, there were also two exceptions to the accuracy of the overall model: Based on ESM data, boredom (low challenges, greater skills) was unexpectedly associated with positive affect, and affect in a state of 'control' (i.e. moderate challenges, greater skills) was also more positive as initially expected (Clarke & Haworth, 1994).

Fong, Zaleski, and Leach (2014) conducted a meta-analysis to draw conclusions as to the importance of the challenge–skills balance as an antecedent of

flow. They analysed 24 studies, which reported data on the challenge–skills balance (studies which did not calculate this balance had been excluded). Overall, they concluded that the challenge–skill balance was generally a good predictor of flow. In addition, the authors conducted a range of moderator analyses, including age, culture, and the flow domain as potential mediators between the challenge–skill balance and flow. Findings for age appeared to be inconclusive, with Fong et al. (2014) suggesting underlying non-linear effects. Culture was found to be a moderator, with the relationship between challenges and skills stronger for international samples compared to US samples. The flow domain was also a moderator, with the impact of the challenge–skills balance on flow being strongest in leisure and personal contexts, and least in work contexts. Thirteen out of the 24 studies also measured the other eight flow components. With regard to these components it was found that clear goals and a sense of control were also predictive of the experience of flow. In addition to this meta-analysis, a range of other moderators between the challenge–skill balance and flow were identified. These included, for example, the achievement motive (Engeser & Rheinberg, 2008), locus of control (Keller & Blomann, 2008), and action-orientation (Keller & Bless, 2007).

It should also be noted that, of the three components described as antecedents of flow (challenges and skills, goal clarity, and feedback), goal clarity and feedback on task performance received much less research attention. One reason may have been that these components were not included in the quadrant or octant models of flow. Another reason was given by Keller and Landhäußer (2012) who concluded that these two components were already implicitly included in the balance of challenges and skills. However, research moved beyond the antecedents of flow

included in the nine characteristics and identified a plethora of psycho-social factors acting as potential facilitators of flow.

1.6 Psycho-Social Factors as Antecedents of Flow

Both personality (dispositional) and situational factors were proposed to be equally important in facilitating flow. Kimiecik and Stein (1992) emphasised that neither factor by itself was sufficient and that flow would be elicited 'almost always by an interaction of the two' (Kimiecik & Stein, 1992, p. 149). This principle of interaction between the person and situation was also adopted by other researchers. For example, experimental research by Keller and Bless (2007) highlighted the importance of 'regulatory compatibility' for the occurrence of flow, the compatibility between person and situation factors (in this case the person's skills and challenges). Furthermore, Csikszentmihalyi pointed out the following about experiences of flow:

> While such events may happen spontaneously, it is much more likely that flow will result either from a structured activity, or from an individual's ability to make flow occur, or both. (Csikszentmihalyi, 1990, p. 71)

The impact of situational factors on flow was found in both work and sports contexts. Flow in work was found to be facilitated by a range of environmental factors that included an innovative learning environment (Fagerlind, Gustavsson, Johansson, & Ekberg, 2013), skill variety, autonomy (Fullagar & Kelloway, 2009), and motivating job characteristics (Demerouti, 2006). In sports, environmental resources such as autonomy, a supportive coach, and feedback on performance (Bakker, Oerlemans, Demerouti, Slot, & Ali, 2011) were found to facilitate flow, whereas time-outs and other non-optimal situational characteristics were found to disrupt flow (Chavez, 2008). Furthermore, the magnitude of the importance of

situational versus dispositional characteristics was estimated. Based on a sample of architectural students who completed ESM data for 14 weeks, Fullagar and Kelloway (2009) identified that 74% of the variance in flow was explained by situational variables, yet the researchers also maintained that personality factors were important, too.

However, despite this evidence of the importance of situational characteristics in explaining flow, it should be pointed out that changing the environment to optimize its conditions for flow would not necessarily lead everyone to experience it. Moneta (2012a), studying flow experiences in a sample of workers found that the opportunity for creativity a job may offer (i.e. a situational variable) moderated the relationship between trait intrinsic motivation and flow in work. Workers whose trait intrinsic motivation was high, and who held a job which was rated as providing ample opportunities for creativity, were more likely to experience flow in work than in leisure contexts. Trait intrinsic motivation was found to be 'harmful' to flow experiences of workers with high trait intrinsic motivation whose jobs provided little opportunity for creativity. These results lent support to the assumption that a specific activity may be flow conducive for some people whereas it might be preventing flow for others. Therefore, an optimal fit between situational and personal characteristics, rather than a 'one-size-fits-all approach', was found to be important in facilitating flow (Moneta, 2012a).

1.6.1 Personality Factors

1.6.1.1 Autotelic Personality

Not everyone recognises flow, nor do people report flow experiences with the same frequency and intensity. As Mosing et al. (2012) commented, 'there are large individual differences in how often people experience flow in daily life' (p. 699), and it was generally acknowledged that these inter-individual differences could not be explained purely based on situational characteristics and that they might be due, at least partly, to personality variables. As discussed, despite the activity being an important source of flow, Csikszentmihalyi (2000) introduced three interrelated intrinsic constructs that bridged personal, situational, and experiential factors: Autotelic activities, autotelic experiences, and autotelic personalities (Csikszentmihalyi, 2000). [4] An illustration of these three constructs could be a child playing with building blocks, stacking them up high and cheering when they came crashing down. The child was fully engaged in what could be considered an autotelic activity, purely for the intrinsic enjoyment of play rather than any external reward (i.e. 'autotelic activities are patterns of action which maximize immediate, intrinsic rewards to the participant', p. 21). During this activity, he may have had the autotelic experience of flow (i.e. 'an autotelic experience is a psychological state, based on concrete feedback, which acts as a reward in that it produces continuing behaviour in the absence of other rewards', p. 23). Perhaps he found flow easily, either based on an innate predisposition or through the process of developing an autotelic personality facilitated by his upbringing; he 'is able to enjoy what he is doing regardless of whether he will get external rewards for it'. (Csikszentmihalyi, 2000, p. 22). This

[4] As described by Csikszentmihalyi (2000, p. 10), the autotelic label was derived from the Greek words auto = self and telos = goal.

definition of the autotelic personality is also referred to as flow personality (Baumann, 2012). It focused on the notion that aspects of one's personality increased intrinsic interest in experiences, and therefore also increased ones chances of experiencing flow. Nakamura and Csikszentmihalyi (2005) described several markers or 'metaskills' of the autotelic personality that facilitated intrinsic interest in a task; these include curiosity and interest in life, low self-centeredness and persistence. Rathunde (1988), who set out to understand if the family environment might nurture an autotelic personality, researched the family context of teenagers. Utilising ESM data from 395 high school students, a family context that promoted choice, clarity, the centring of attention on specific tasks without interruptions, commitment/trust, and challenges, was operationalised as an autotelic family environment. This environment was found to be positively related to the students' quality of experiences at home as well as in school and with friends. These findings suggested that a supportive family environment could contribute to the development of an autotelic personality and therefore pave the way for future flow experiences not just at home but also in other contexts. Yet, the autotelic personality has still remained a relatively elusive construct. It was operationalised in a range of ways that included the time spent in flow, the frequency with which flow was experienced, and the level of intrinsic motivation in flow conducive high-challenge and high-skill situations (Asakawa, 2010; Nakamura & Csikszentmihalyi, 2005). For example, correlates of the autotelic personality (as measured via flow frequency) were found to be positively related to a range of well-being measures in Japanese college students after controlling for demographic variables (Asakawa, 2010). Positive correlations were found with self-esteem, adaptive coping, will for a meaningful life, and Jujitsu-kan, a Japanese concept of well-being. Flow frequency correlated

negatively with maladaptive coping strategies, trait anxiety, disengagement from college life, and maladaptive career decision strategies. Overall, even though the underlying mechanisms were not fully understood, research suggested that an autotelic personality made people experience flow more easily, which in turn might have contributed to their overall well-being.

1.6.1.2 Other Personality Variables Facilitating Flow

A range of other personality variables was also found to be associated with eliciting and sustaining the experience of flow (Partington, Partington, & Olivier, 2009). For example, a variety of studies supported links between flow and a range of personality traits (e.g. Ullén et al., 2012; Ross & Keiser, 2014; Mosing et al., 2012). Research by Ross and Keiser (2014) found 38% shared variance between global flow NEO personality inventory domains and reported that previous findings accounted for 22% to 50% of shared variance. A study by Teng (2011), based on a sample of 372 online game players, found positive associations between flow and novelty seeking, persistence, and self-transcendence, and negative associations with self-directedness. Furthermore, high internal locus of control (Rotter, 1966), people's feeling of whether they are in control over their actions, was found to moderate the relationship between challenge–skills balance and flow (Keller & Blomann, 2008). People who exhibited a high internal locus of control were found to be more sensitive to matching demands and skills, which in turn elicited flow experiences, while for people with an external locus of control, this did not lead to flow. Another relevant personality construct in relation to flow was the concept of action versus state orientation (Kuhl & Beckmann, 1994). Action-orientation was described as a trait that 'contributes to one's readiness to experience deep involvement during task engagement' (Keller & Bless, 2007, p. 197). Based on experimental research on a

sample of undergraduate students, action-orientation was found to moderate the relationship between the balance of skills and task demands and flow.

As noted earlier, research by Moneta (2012a) pointed out the importance of an adequate match between personal and situational characteristics in facilitating flow experiences at work. Other studies, e.g. Salanova, Bakker, and Llorens, (2006) also found support for both situational and personality variables that interdependently facilitated flow. They conducted a longitudinal two-wave study of flow at work on a sample of 258 secondary school teachers. They measured flow with the WOrk-reLated Flow scale (WOLF; Bakker, 2008), which conceptualised flow as 'a short-term peak experience at work that is characterized by absorption, work enjoyment and intrinsic work motivation' (Salanova et al., 2006, p. 2). Their results showed that both personality variables (i.e. personal resources operationalised as self-efficacy beliefs) and situational variables (i.e. organizational resources) fostered flow at work. In turn, flow at work led to enhanced organizational and personal resources, with the authors suggesting an 'upward spiral' between the constructs.

In summary, an ever-increasing variety of situational and psychological antecedents of flow was discovered. However, overall, research pointed at an interactionist perspective on flow, which took account of both situational and personality factors.

1.7 Consequences of Flow

Flow was described as an optimal mental state which self-perpetuated people to repeat this optimal experience because of the intrinsic enjoyment it provided. This would ultimately lead to ever increasing levels of skills. Therefore, one may assume

that being in flow was naturally ‘good’. Yet, both positive and negative consequences of flow were highlighted (e.g. Csikszentmihalyi & Csikszentmihalyi, 1988; Moneta, 2014; Partington et al., 2009). Positive consequences of flow, such as increased well-being (e.g. Asakawa, 2004, 2010) , mood (e.g. Fullagar & Kelloway, 2009; Partington et al., 2009), and creativity (MacDonald, Byrne, & Carlton, 2006) were found in a range of studies. Flow was also found to have positive influence over attitudes and behavioural intentions in online and web purchasing environments (Hoffman & Novak, 2009). Furthermore, a positive consequence that received increased research interest, particularly for its practical applications in the domains of work, education, and competitive sports, was performance. A range of correlational studies found positive relationships between flow and enhanced performance in work (e.g. Demerouti, 2006; Eisenberger, Jones, Stinglhamber, Shanock, & Randall, 2005; Bakker et al., 2011; Schüler & Brunner, 2009), as well as adaptive functioning in a range of other domains such as sports (Jackson & Roberts, 1992; Partington et al., 2009), education (Cermakova et al, 2010), and online environments (i.e. increased learning, Hoffman & Novak, 1996). However, based on the correlational nature of these studies the direction of the relationship was not clear. Rather than flow leading to enhanced performance, enhanced performance expressed via the mastery of skills could also lead to flow. Further, Engeser and Rheinberg (2008) hypothesised that flow should be related to performance, as it is a ‘highly functional state’. Because of the intrinsically motivating characteristics of flow, learning and seeking out of increasingly challenging tasks should be perpetuated. Also, using flow as a means to enhance performance appeared to be a subject of contention, as the following quote by Csikszentmihalyi (1988) illustrated:

> Most people are unimpressed by the fact that flow provides an optimal subjective experience, but their interest immediately perks up at any suggestion that it might improve performance. (…) As soon as the emphasis shifts from the experience per se to what you can accomplish with it, we are back in the realm of everyday life ruled by extrinsic consideration. (Csikszentmihalyi, 1988, p. 374)

Perhaps one of his concerns lay in the potential for people's flow experiences at work to be exploited in order to achieve increased productivity and ultimately financial gain. Yet his words of caution seemed to some extent to be unwarranted. If there was indeed a (causal) link between flow and performance, one could not have one without the other. More frequent or intense flow experiences would naturally lead to increased performance. In work contexts, this appeared to be a win–win situation for both the employee and the employer, rather than a question of the ethics underlying the outcomes of states of subjective well-being. Interestingly, flow research in the context of sports appeared to be less critical of exploiting this consequence of flow in order to enhance an athlete's performance. Nevertheless, it is important to also highlight potential downsides of flow.

Negative consequences of flow were mainly reported with regard to the potentially addictive properties of the experience. Evidence of this was found particularly in online gaming addiction (e.g., Chen, 2006) but also in sports, such as big wave surfing (Partington et al., 2009). Furthermore, Partington et al. (2009) argued that an autotelic personality might not only facilitate flow experiences, it may also make people more vulnerable to the addictive properties, the 'dark side' of flow experiences, about which Csikszentmihalyi (2000) had previously warned. Pointing out the negative consequences of flow, Csikszentmihalyi (2002) quoted the Greek philosopher Democritus' analogy of the benefits and dangers of water by comparing it to the flow experience. 'Water can be both good and bad, useful and dangerous. To the danger, however, a remedy has been found: learning to swim' (p. 70). As one can

prevent oneself from drowning his suggestion was also to ‘learn to swim’ when it comes to flow: ‘To swim in this case involves learning to distinguish the useful and the harmful forms of flow, and then making the most of the former while placing limits on the latter.’ (Csikszentmihalyi, 2002, p. 70). Yet, more research is needed to understand the negative effects of flow (Moneta, 2014).

1.8 Flow and Coping

Getting totally absorbed in an activity while forgetting the world around oneself has another important consequence; flow could be seen as a consequence of coping efforts as well as a means to cope. A theoretical link between flow and coping was introduced early on in the inception of flow theory. An awareness of one’s skills was described as the ‘capacity to cope with the demands’ (Csikszentmihalyi, 2002, p. 50) by Csikszentmihalyi as he outlined the rational of his initial model of flow:

> The model is based on the axiom that, at any given moment, people are aware of a finite number of opportunities which challenge them to act; at the same time, they are aware also of their skills that is, of their *capacity to cope with the demands* imposed by the environment. When a person is bombarded with demands which he or she feels unable to meet, a state of anxiety ensues. When the demands for action are fewer, but sill more than what the person feels capable of handling, the state of experience is one of worry. Flow is experienced when people perceive opportunities for action as being evenly matched by their capabilities. If, however, skills are greater than the opportunities for using them, boredom will follow. (Csikszentmihalyi, 2000, p. 50, emphasis added)

Based on this quote, it could be implied that flow was a state that could arise when a person coped well with the demands of the situation. For example, Logan (1988) described that even under the most difficult of circumstances some people were still able to transform almost any (adverse) experience into flow. His descriptions of people who endured solitary ordeals showed that they exhibited

strong self-regulation abilities in order to transform challenging, flow-prohibitive situations into ones where flow could be found. Logan also noted a link between people who coped well and their ability to enter flow easily: 'It is also true that some individuals who cope successfully are unusually capable of setting up flow experiences' (Logan, 1988, p. 173). He concluded, albeit based on anecdotal rather than empirical evidence, that people who were not focused on themselves, who exhibited 'non-self-conscious individualism', were more likely to transform ordeals into flow. Overall, getting into flow could be seen as an adaptive way for coping with these extreme circumstances, having chosen a state of subjective optimal experience, in order to escape the objective properties of the situation.

Conditions, however, do not need to be necessarily as dire as the solitary ordeals described by Logan (1988). Everyday situations such as encountering demanding situations at work or in competitive sports, or having to perform at one's peak, might give rise to the use of flow as a way to cope with a particularly demanding situation. Weimar (2005) suggested that, in addition to being the outcome of the coping process, flow could also be a way of coping. Similarly, Lazarus, Kanner, & Folkman (1980) acknowledged the role flow could play during the coping process. They referred to flow as 'sustainer of coping', an emotion that helped people keep going during the coping process:

> What has recently been referred to as 'flow' (see Csikszentmihalyi, 1976; Furlong, 1976) appears to be an extremely pleasurable, sustaining emotion that arises when one is totally immersed in an activity and is utilizing one's resources at peak efficiency. (…) Although the experience of flow is characterized by a feeling of effortlessness, it occurs at times when great coping effort is usually required and during these times serves as a powerful sustainer of coping. (Lazarus et al., 1980, p. 209)

Two types of coping, approach and avoidance coping, appeared to have particular relevance in the context of flow research. Zuckerman and Gagne (2003)

described the main characteristics of approach coping as taking action to overcome a problem (e.g. 'I take direct action to get around the problem'); planning (e.g. 'I make a plan of action'); and suppressing competing activities (e.g. 'I try hard to prevent other things from interfering with my efforts at dealing with this') (Zuckerman & Gagne, 2003, p. 177). In contrast, avoidance coping referred to denial (e.g. 'I refuse to believe that it has happened'); behavioural disengagement (e.g. 'I admit to myself that I can't deal with it, and quit trying'); mental disengagement (e.g. 'I try to forget the whole thing'); and the refusal to admit self-blame and blaming others instead (e.g. 'I accuse someone of causing my misfortune') (Zuckerman & Gagne, 2003, p. 177). The suppression of competing actions as a way of mental disengagement seemed to be particularly relevant in the context of flow, as the complete absorption in an activity could help to suppress and escape. This was analogous to what Lazarus et al. (1980) described as 'breathers' from stress; i.e. 'to engage in pleasurable diversionary activity' and 'free oneself temporarily from a stressful experience' (p. 208). This form of 'escapist flow' could also be found in quotes of Csikszentmihalyi and Csikszentmihalyi's (1988) interviewees:

> Sometimes on court I think of a problem, like fighting with my steady girl, and I think that's nothing compared to the game. You can think about a problem all day, but as soon as you get in the game, the hell with it! (Csikszentmihalyi & Csikszentmihalyi, 1988, p. 33)

Asakawa (2010) briefly touched on the subject of adaptive coping and flow in a study of Japanese college students. It was found that those students who experienced flow more frequently in their daily lives, and were therefore described as being more autotelic, were also more likely to employ problem-focused or emotion-focused coping strategies. They were also less likely to engage in maladaptive coping, characterized by the avoidance of problems. Using flow as an adaptive way to cope,

however, would require some level of self-regulation of flow experiences. As described by Koole, Jostmann, and Baumann (2012), 'the term "self-regulation" denotes the psychological capacity that allows people to bring their thoughts, feelings, and actions in line with abstract standards, goals, or values' (p. 329). Self-regulation did not always need to be conscious or effortful and could also include more automatic processes. Indeed, a number of studies, as described in the next section, alluded to people's ability in self-regulating flow.

1.9 Self-Regulation of Flow Experiences

Even though it was suggested that some people might possess important metaskills in 'making flow happen', little systematic research has been conducted to shed light on the self-regulation of flow experiences. For example, a qualitative study by Chavez (2008) assessed flow experiences in a sample of 16 US college athletes. The analysis focused particularly on the level of 'volitional control' athletes had over factors implicated in entering, sustaining, and preventing flow. As Chavez (2008) pointed out, there had been a lack of consensus among researchers on whether flow states were 'controllable' or whether they 'just happen', and called for research to better understand potential factors affecting the frequency of flow experiences. Based on qualitative data, it was found that the large majority of athletes, 69%, stated that flow was indeed controllable. These results were compared to previous research on flow in elite and college athletes by Jackson (1995) and Russel (2002), who found that of their samples, 79% and 64% respectively, perceived flow as controllable. The main factors, which were found to increase the controllability of flow, were preparation, positive thinking, and optimal arousal. Athletes who felt that they had no or little control over flow most frequently quoted environmental or situational factors that prevented them from controlling flow

(Chavez, 2008, p. 71). A systematic literature review of flow in elite sports, with the analysis concentrating on the experience, occurrence, and controllability of the flow state, was conducted by Swann et al. (2012). Seventeen papers were found to match the authors' search criteria and provided sufficient academic rigor to be included in the analysis. All studies were conducted prior to 2011 and were published in peer-reviewed journals in the English language. Based on the review it was found that on average, 66% to 72%[5] of athletes perceived flow to be controllable; whereas, an average of 27% reported that it was not. It should be noted that these studies focused exclusively on the controllability of flow in the specific domain of sports and predominantly used a select group of experienced athletes. Furthermore, other areas of research might be able to advance the understanding of self-regulation processes in flow as well as coping. A particular promising area has been the literature on metacognition which has investigated people's knowledge and beliefs about their cognitive efforts.

1.10 Metacognition

'Metacognition refers to the psychological structures, knowledge, events and processes that are involved in the control, modification and interpretation of thinking itself.' (Wells & Cartwright-Hatton, 2004, p. 386). The historical lines of metacognitive research are outlined only briefly, as the research most relevant to advance flow theory was developed more recently, i.e. maladaptive or pathological metacognitions and adaptive metacognitions. These metacognitive traits were found to be particularly relevant in the explanation of successful coping. The concept of metacognition had its origins in developmental psychology (Flavell, Friedrichs, &

[5] The average was based on the inclusion of either three or four studies that reported on the controllability of flow in sport.

Hoyt, 1970; Flavell, 1979) and cognitive psychology (e.g. Nelson & Narens, 1990). Both strands of research were developed relatively independently of each other over the years (Perfect & Schwartz, 2002). Since then the concept has found a wide range of applications in areas such as educational psychology, developmental psychology, clinical psychology, and, most recently, positive psychology.

Flavell (1979) described metacognition as people's knowledge of cognitive processes and their cognitions about cognitions, leading to four types of phenomena (metacognitive knowledge, metacognitive experiences, goals/tasks, and actions/strategies), which comprised a proposed model of cognitive monitoring. Metacognitive knowledge was described as one's knowledge about being 'a cognitive creature' entailing the ability to perform cognitive tasks and having cognitive experiences (Flavell, 1979, p. 906). Metacognitive experiences were outlined as conscious experiences such as a puzzling feeling when one realises one has misunderstood something. Knowledge about cognitive tasks (or goals of a task), for example, refers to the information available during a specific task, such as the knowledge that familiar learning material is easier than unfamiliar material. It could also refer to knowledge about the cognitive demands posed by the task or the goal that one tried to achieve (e.g. knowledge that verbatim rehearsal of a story would be more difficult than the remembrance of only the gist of it). In order to achieve a 'cognitive enterprise', one would carry out actions or strategies. In particular, knowledge could be acquired about specific strategies that have been successful, depending on the cognitive task. Flavell's model has been used in the field of developmental psychology, e.g. for comparing the differences in children's metacognitive capacities at different developmental stages. For example, in a comparative study of preschool and elementary school children it was found that

younger, preschool children had difficulties in the monitoring of their learning progress of a set of items and showed poor recall of these items even after they felt that they had learned them sufficiently. Older children, in elementary school, however, had developed sufficient metacognitive skills to master this task (Flavell et al., 1970). Pezzica, Pinto, Bigozzi, and Vezzani (2015) explored metaknowledge of attention in children. They found that younger children (aged six to eight) possessed behavioural awareness, pragmatic awareness, and social awareness of attention; however, emotional and cognitive awareness of attention were found only in older children (aged eight to ten). The authors pointed out the practical application of these findings for enhancing children's learning. Younger children should be made to focus on external monitoring, such as understanding that looking out of the window, for example, would be distracting. While older children should be able to focus internally to monitor and self-regulate their attention.

From a cognitive psychology perspective, Nelson and Narens (1990) developed a model of information processing whereby information flowed between two or more connected levels during cognitive processes, the meta-level and the object level. The object level was represented via a 'dynamic model' in the meta-level, which was continuously updated based on new information. The meta-level exerted control over the object level via information flowing from the meta- to the object level and initiated actions at the object level. Information also flowed vice-versa, to allow the meta-level to monitor the object-level. Control and monitoring constituted 'two dominance relations' between the meta- and the object level. This model of monitoring-and-control has been used to explain a range of cognitive processes, such as understanding students' learning progress during the acquisition of new information. In order to elicit people's metacognitive knowledge, one has to

ask them to reflect on their mental processes. Querying people about their mental processes, however, raised the question of how metacognition differed from mere introspection. Koriat (2002) noted an important distinction between the two terms by highlighting the potentially causal effect of metacognition on cognition and behaviour:

> One of the reasons for the increased interest in metacognition lies in the belief that subjective experience is not a mere epiphenomenon, but actually affects and guides controlled cognitive processes and behaviour. Hence the interest in subjective reports is not only because such reports may mirror mental processes (as is generally the case when introspective reports are obtained). Rather, it is because subjective beliefs and feelings are assumed to play a causal role in affecting the regulation of cognitive processes and behaviour. (p. 262)

Metacognitions have also been linked to affecting attitude change (e.g. Briñol & DeMarree, 2012). The importance of a causal role of metacognitions in affecting cognition and behaviour has been particularly dominant in the field of clinical psychology.

1.10.1 Maladaptive Metacognitions

In the clinical context, Wells and Matthews (1994) developed a theoretical framework for the function of maladaptive metacognitions in the persistence of mental disorder. The Self-Regulatory Executive Function (S-REF) model (Wells, 2000, 2011; Wells & Matthews, 1994) predicted that mental disorder was manifested and perpetuated via a general maladaptive thinking style; the cognitive attentional syndrome (CAS). The CAS constituted three components, i.e. worry and rumination, threat monitoring, and maladaptive coping behaviours (Wells, 2008), which, based on the model developed by Wells and co-workers, were activated in relation to coping with negative emotions and events. For example, emotionally vulnerable people could use worry and rumination episodes as a way to cope with negative

automatic thoughts (Wells, 2008). Another maladaptive way to cope with negative events, was threat-monitoring, whereby attention was focused on internal or external threats, which in turn perpetuated threat focus and led to increased anxiety. The underlying causes of the CAS were maladaptive or pathological metacognitions, which 'comprised of tacit knowledge or programs and verbally accessible beliefs' (p. 652). Wells (2008) distinguished between positive and negative metacognitive beliefs, both types leading to maladaptive thinking. Positive metacognitions referred to people's beliefs 'about the need to worry, ruminate and engage in strategies such as threat monitoring' (p. 652). For example, positive metacognitive beliefs would be expressed as follows: 'If I analyse why I've failed I'll be able to overcome my depression' (p. 652). Negative metacognitive beliefs referred to people's beliefs regarding the uncontrollability and danger of thoughts, e.g. 'If I think bad thoughts I will act badly' (p. 652). These metacognitions would control attentional processes and would lead to focus on negative thinking.

Wells and co-workers found these pathological metacognitions to be associated with psychological maladaptation in clinical samples of patients with obsessive-compulsive disorder, generalized anxiety disorder, and problem drinking (e.g. Wells, 2000; Solem, Håland, Vogel, Hansen, & Wells, 2009; Spada & Wells, 2010). Meaningful associations in non-clinical samples were also found between maladaptive metacognitions, perceived stress and negative emotions (Spada, Nikčević, Moneta, & Wells, 2008), problematic internet use (Spada, Langston, Nikčević, & Moneta, 2008), and negative emotions and alcohol dependence (Moneta, 2011). Myers and Wells (2013) experimentally manipulated metacognitive beliefs related to intrusive thoughts and reported a causal link between (maladaptive) metacognition and obsessive-compulsive symptoms. Maladaptive metacognitions

were measured with the 60-item or brief 30-item version of the Metacognitions Questionnaire, (MCQ, Wells & Cartwright-Hatton, 2004). The MCQ comprised five intercorrelated, although conceptually distinct, metacognitive factors: cognitive confidence; positive beliefs about worry; cognitive self-consciousness; negative beliefs about uncontrollability of thoughts and danger; and beliefs about the need to control thoughts. These five factors fell into three broad metacognitive domains: positive and negative metacognitive beliefs, metacognitive monitoring, and judgments of cognitive confidence (Wells & Cartwright-Hatton, 2004). The MCQ was validated with clinical and general population samples. The shortened measure correlated meaningfully with pathological worry and trait anxiety, supporting its convergent validity. Test-retest reliability suggested that the five metacognitive factors were relative stable over time, indicating that they were trait-like, although with one factor (i.e. negative beliefs about uncontrollability of thoughts and danger) having only modest temporal stability. This was explained by people's beliefs about mental control being influenced by environmental factors (Wells & Cartwright-Hatton, 2004). Furthermore, one of the most important aspects of pathological metacognitions was that they were amenable. For example, a study by Papageorgiou and Wells (2000), using the 60-item version of the MCQ to assess maladaptive metacognitions, found that these were sensitive to treatment effects based on a clinical sample undergoing metacognitive therapy aimed at modifying maladaptive beliefs. Their research supported the notion that pathological metacognitions, albeit described as traits, could be altered by targeted intervention.

However, despite the promising results related to the alleviation of pathological 'thinking about thinking' and related reduction in mental ill-health, maladaptive metacognitions have not furthered our understanding of human

flourishing. As Moneta (2014) noted, although maladaptive metacognitions were good predictors of psychological ill health, they failed as predictors of indicators of well-being. Yet a newly discovered construct was able to fill this gap. Adaptive metacognitions, which were built upon maladaptive metacognitions but from a positive psychology perspective, have not only been able to predict subjective well-being, they could also be closely linked to the experience of flow.

1.10.2 Adaptive Metacognitions

Beer and Moneta (2010) studied metacognitions in the context of positive psychology by starting with the core assumption in this field of psychology, 'that psychological adaptation is not solely due to absence of maladaptive dispositions, but is also fostered by adaptive dispositions' (p. 977). Their work formed an important antithesis to the research on maladaptive metacognitions. Although the programme of research by Wells and co-workers on dysfunctional 'cognitions about cognitions' has had important applications, these have remained predominantly in the realm of clinical psychology routed in psychological ill health rather than expanding the understanding of human flourishing and optimal functioning. Based on interviews with a sample of highly self-regulated people who reported on their processes of cognitive and emotional self-regulation during demanding encounters, a measure of adaptive metacognitions and meta-emotions was developed, the Positive Metacognitions and Positive Meta-Emotions Questionnaire (PMCEQ, Beer & Moneta, 2010). Research using the PMCEQ provided initial evidence for three general adaptive metacognitive traits which people exhibited during demanding encounters. These were described as (1) Confidence in Extinguishing Perseverative Thoughts and Emotions; (2) Confidence in Interpreting Own Emotions as Cues, Restraining From Immediate Reaction, and Mind Setting for Problem Solving; and

(3) Confidence in Setting Flexible and Feasible Hierarchies of Goals. Research validating the PMCEQ confirmed that it had good psychometric properties (Beer & Moneta, 2010). General adaptive metacognitions correlated positively with indicators of well-being, such as intrinsic motivation and adaptive coping, highlighting the scale's usefulness (Beer & Moneta, 2010, 2012a). Confidence in Extinguishing Perseverative Thoughts and Emotions correlated relatively highly and negatively with the MCQ-30 subscale Negative Beliefs about Worry Concerning Uncontrollability and Danger, which indicated that this factor may be to a large part the reverse of this maladaptive trait. The other two factors, however, only correlated very weakly with the MCQ-30 subscales, which indicated that there was little overlap between the constructs.

All three PMCEQ subscales appeared to have direct relevance to flow experiences. For example, PMCEQ items for Confidence in Extinguishing Perseverative Thoughts and Emotions, included e.g. 'I tend to overreact when things are really going wrong' (reversely scored) or 'I tend to think that my worrying thoughts might reflect the reality' (reversely scored). People who exhibited this metacognitive trait would be able to exercise control over their worry and negative emotions. As negative states, such as worry or anxiety, were found to be incompatible with the flow state as per e.g. the octant model of flow (Massimini & Carli, 1988), it followed that people who were able to refrain from giving into worrying thoughts would also be more likely to enter flow. The second factor described people's Confidence in Interpreting Own Emotions as Cues, Restraining From Immediate Reaction, and Mind Setting for Problem Solving, (e.g. 'In difficult situations I quickly "rationalize" my fear by assessing cost and benefits of "confronting versus escaping"' or 'I can stop any "negative thinking spirals" and

focus on what I can do in the situation'). This factor appeared to be relevant in eliciting flow experiences during demanding encounters, as it highlighted the importance of self-regulating focused attention and exerting control over the situation. The third factor was labelled Confidence in Setting Flexible and Feasible Hierarchies of Goals, with items including e.g. 'If I were overwhelmed by a big task I would stop and take smaller steps' or 'When a problem appears to be insurmountable I know that it's just a matter of breaking it down into smaller problems'. This flexibility in evaluating the difficulty of a situation and setting achievable sub-goals seemed to be most likely to be related to the facilitation of flow experiences. It appeared to be capturing metacognitive skills associated with the three preconditions of the flow experience, i.e. a balance between demands and skills, clarity of goals, and immediacy of feedback. People with this trait might stop the challenges of the situation getting the better of them by breaking tasks down into smaller steps which would become more manageable and in tune with their level of skills, i.e. balancing the task demand with their skills. A consequence of breaking a big problem into smaller tasks could be having better defined sub-goals. These could in turn have facilitated the immediacy of feedback on completion of each of the sub-tasks rather than the delaying of feedback until the completion of an 'insurmountable' task. In summary, all three adaptive metacognitive traits appeared to have direct applications to flow as an optimal mental state.

As outlined, there could be interesting theoretical links between adaptive metacognitions and flow. Furthermore, as suggested by Beer (2011), both adaptive metacognitions and flow were activated via similar mechanisms, specifically the demands of the situation (Beer, 2011). Yet, the relationship with flow was only hypothesised and not empirically investigated. Also, any potential relationship

between flow and maladaptive metacognitions have yet to be understood. An initial link between adaptive metacognitions and flow was first reported by Moneta (2015). In a sample of 486 workers, adaptive metacognitions were found to foster flow in work both directly and indirectly via the activation of positive affect, whereas maladaptive metacognitions counteracted the experience of flow in work only indirectly and this was via the activation of negative affect.

Based on this research, adaptive metacognitions, in particular people's confidence in setting flexible and feasible hierarchies of goals, could be seen as a precursor to flow, an antecedent that enabled the flow experience (directly or indirectly via positive affect). In particular, Beer and Moneta (2012a) commented that Confidence in Interpreting Own Emotions as Cues, Restraining from Immediate Reaction, and Mind Setting for Problem Solving and Confidence in Setting Flexible and Feasible Hierarchies of Goals conceptualised as a combined adaptive metacognitive trait enabled people to respond flexibly to demanding situations. As outlined by Beer and Moneta (2012a), 'people who score low on this trait believe they lack ability to act upon a stressor. As such, they are likely to experience an increased dissonance between the perceived demands of the situation and their own coping ability' (p. 108). In relation to flow theory, these adaptive metacognitions could be implicated in affecting an important antecedent of flow, i.e. people's perception of the challenges/demands of a situation, as well as their level of perceived skills to tackle the demands. Based on the models of flow presented (and in Chapter 3), flow particularly emerged if both were in equilibrium (i.e. a balance of challenges of skills) and if this balance was above a person's average. People with high scores on this adaptive metacognitive trait would therefore be able to act flexibly during demanding situations, by adjusting the demands of the situation (e.g.

breaking down a daunting task into more manageable sub-tasks) and therefore matching them better to their perceived level of skills, thereby transforming a potentially stressful situation into an experience of flow. This would constitute an adaptive way of coping with the situation. However, people who scored at the lower end of adaptive metacognitions would lack this flexibility and would therefore experience anxiety instead of flow.

As hypothesised by Beer and Moneta (2012a), their research confirmed that maladaptive metacognitions did not predict adaptive coping; however, an absence of maladaptive as well as a presence of adaptive metacognitions predicted adaptive coping. In relation to coping efforts, flow was described as an outcome of coping as well as a tool to cope adaptively with highly demanding situations. As previously mentioned, Lazarus called flow a 'sustainer of coping'. In this context, adaptive metacognitions could be an important factor in transforming challenging situation into an experience of flow.

1.10.3 Flow Metacognitions

Despite a theoretical link between general adaptive metacognitive functioning, in particular cognitive self-regulation and flexible goal restructuring, and flow in demanding situations, the potential of metacognitive functioning specific to flow, which in turn might impact on flow experiences, had not been explored. As the measure for adaptive metacognitions assessed more general, broad metacognitions, not specifically tailored to the flow state, it was important to understand if people held specific metacognitive beliefs on flow as a state of optimal cognitive functioning.

However, the following question might be posed: Could it at all be possible to hold metacognitive beliefs on flow, to reflect on flow as a state of optimal cognitive functioning and to have an awareness of the self-regulation of this cognitive experience? Csikszentmihalyi (2000) had pointed out, when describing the merging of action and awareness as one of the key elements of flow, that self-reflection on the flow state would be difficult: 'A person in flow has no dualistic perspective: he is aware of his actions but not of the awareness itself. A tennis player pays undivided attention to the ball and the opponent (…) yet for flow to be maintained, one cannot reflect on the act of awareness itself' (p. 38). However, what Csikszentmihalyi (2000) described here was one's reflection on flow while in flow, which would naturally interrupt or terminate the experience, at least temporarily. Engeser and Schiepe-Tiska (2012) rightly argued that people's lack of self-awareness while in flow did not equal to being in a state of unconsciousness and, therefore, did not mean that one could not report on it retrospectively. Similarly, people should be able to report on global cognitions on their flow experiences, such as any knowledge of potential factors that may foster the flow state (e.g. removing distractions), any factors that may regulate flow (e.g. controlling attentional processes by focusing more intensely on the task at hand), rather than the description of their cognitions while in a state of flow.

Despite the potential importance of self-regulation of flow, inter-individual differences in people's beliefs about the self-regulation of flow were only described in the context of elite sports (e.g. Catley & Duda, 1997). If there were indeed inter-individual differences in people's beliefs on the flow state, flow metacognitions could be considered a facet of the autotelic personality. As Csikszentmihalyi (2000) pointed out 'some people apparently can enjoy the least autotelic activities, whereas

others need external incentives even to do things rife with intrinsic rewards' (p. 22). Therefore, metacognitions specific to flow could enable people, particularly in situations where intrinsic interest might be low, to still experience flow.

1.11 Scope and Aim of PhD Dissertation

The overall aim of the dissertation was to advance flow theory by researching flow metacognitions, a construct which had to date not been given a general definition, measured or tested for its relevance in the context of flow experiences. The scope of the dissertation included the identification of flow metacognitions, as well as the development, validation, and testing of a bespoke questionnaire for their measurement. This was achieved by conducting four research studies. The PhD dissertation concluded with the identification of a new and important construct, which was positively associated with adaptive metacognitions and causally linked to the experience of flow in work. Flow was measured as a disposition in the context of work as this research aimed to enhance the understanding of potential markers of the autotelic personality, people's general proneness to experience flow. Therefore, it was important to establish the broader relationship between flow metacognitions and the autotelic aspects of flow (i.e. flow as a disposition) first, before the assessment of the specific underlying processes of flow metacognitions. This research could provide a starting point for future programmes of research both in terms of flow and adaptive metacognitions as well as interventions, particularly in contexts of achievement, such as work.

1.11.1 Overview of Chapters

Including this introduction (Chapter 1), the dissertation comprises seven chapters. All chapters build upon each other and follow a logical sequence of

research events. Chapters 2, 4, 5, and 6 describe interlinked research studies, each providing the study's aims, an executive summary, followed by a brief introduction to the chapter, the methodology used, the results and their discussion.

Chapter 2 details the initial qualitative study (Study 1) which analysed interview transcripts and qualitative elements of the Flow Questionnaire (FQ) of a sample of workers. Based upon emerging themes on flow metacognitions a pool of questionnaire items was developed, leading to the pilot Flow Metacognitions Questionnaire (FMQ). Chapter 2 is based on a published book chapter by Wilson and Moneta (2012): Wilson, E. E., & Moneta, G. B. (2012). Flow as a Way of Coping – A Qualitative Study of the Metacognitions of Flow. In B. Molinelli, & V. Grimaldo. (Eds.), Handbook of the Psychology of Coping: New Research (pp. 133–150). Hauppauge, NY: Nova Science Publishers.

Chapter 3 briefly details the methodological considerations for the quantitative measurement of flow experiences and outlines the main measures used as part of the PhD research.

Chapter 4 illustrates Study 2, which detailed how the factor structure of the pilot FMQ was tested on a student sample and the identification of two underlying factors (FQM-1 Beliefs that Flow Fosters Achievement; FMQ-2 Confidence in Ability to Self-Regulate Flow). Questionnaire items were subsequently reduced to produce a parsimonious and valid 12-item version of the questionnaire.

Research presented in Chapter 5 confirmed the two-factor structure of the FMQ, tested on a sample of professionals in Study 3. Furthermore, by outperforming established measures of flow and metacognition, initial evidence was provided for the FMQs legitimacy as a research tool and the usefulness of the constructs it

measures. Chapters 4 and 5 were based on a peer-reviewed academic journal article by Wilson and Moneta (2016): Wilson, E. E., & Moneta, G. B. (2016). The flow metacognitions questionnaire (FMQ): A two-factor model of flow metacognitions. *Personality and Individual Differences*, *90*, 225–230. http://dx.doi.org/10.1016/j.paid.2015.11.004.

Chapter 6 details a longitudinal study (Study 4), which assessed state versus trait characteristics of the FMQ subscales. It positioned FMQ-2 as a trait-like antecedent of flow, whereas FMQ-1 was more influenced by the situation. Furthermore, a causal link between FMQ-2 and flow was suggested. Flow metacognition (FMQ-2) was found to have consequences on people's cognitive processes by affecting flow intensity longitudinally. A manuscript of the research included in Chapter 5 was prepared for submission to a peer-reviewed academic journal: Wilson, E. E., & Moneta, G. B. (to be submitted). Flow Metacognition and Flow – Evidence of a Directional Relationship. Manuscript to be submitted.

The final chapter, Chapter 7, provides a summary discussion of the research chapters, contextualising the findings within the literature and concluding with the limitations and an outlook on future research projects.

1.12 Unique Contribution

To the knowledge of the author this is the first time that metacognitions specific to the flow state have been identified and measured, based on a newly developed measure, the Flow Metacognition Questionnaire (FMQ), comprising of two subscales, i.e. Beliefs that Flow Fosters Achievement (FMQ-1) and Confidence in Ability to Self-Regulate Flow (FMQ-2). The FMQ's importance as a research tool has been confirmed as it neither duplicates standardised measures of flow nor

adaptive metacognitions. Most importantly, flow metacognitions, in terms of people's confidence in the self-regulation of flow experiences were found to be predictive of the intensity and frequency of flow, outperforming measures of metacognition and established componential approaches to measuring flow. The main negative finding was that people's beliefs in the usefulness of flow in terms of achievement did not predict flow experiences. This finding, in conjunction with the main positive finding, has both important implications for the theoretical advancement of flow theory as well as potential practical application for facilitating flow in work contexts. In particular, it advances flow theory, as the metacognition Confidence in Ability to Self-Regulate Flow could be interpreted as a marker of the autotelic personality. It was found to be a trait-like personality variable, predictive of the intensity and frequency of flow. It further advances metacognitive theory in the field of positive psychology. Based on the findings presented in this PhD research, a 'toolkit of adaptive functioning' is proposed, which people may draw upon during difficult situations. This may include general adaptive metacognitions, more specific adaptive flow metacognitions, and metacognitions of creativity (Kaufman & Beghetto, 2013), as well as other adaptive metacognitions which await identification.

The research also advances the practical applications of flow theory, particularly in work environments by proposing interventions which aim to modify people's beliefs in the self-regulation of flow rather than focusing on the potential positive consequences of flow.

Chapter 2: Qualitative Study (Study 1)

2.1 Objectives

The objective of the qualitative study (Study 1) presented in this chapter was to identify people's metacognitions on flow as an optimal mental state and to understand if metacognitions specific to flow existed. The identification of metacognitions of flow would be achieved by analysing the textual responses of workers to open-ended questions of a large sample of Flow Questionnaires (FQ, Csikszentmihalyi & Csikszentmihalyi, 1988) as well as conducting interviews with a sample of 12 professionals. Study 1 would be successfully concluded by having identified and categorised potential metacognitions of flow. These constructs would form the basis for the development of pilot questionnaire items for a measure which would systematically assess flow metacognitions, as described in subsequent chapters.

2.2 Chapter Summary

The aim of Study 1 was to identify possible metacognitions on people's flow experiences based on the qualitative analyses conducted. These analyses were twofold: First, qualitative responses to open-ended questions included in the FQs were analysed from a sample of 371 workers. Second, semi-structured interviews were held with a sample of 12 professionals. A range of potential metacognitive constructs emerged from the data. Two factors appeared to be particularly relevant as they captured individual differences in people's ability to self-regulate flow experiences, as well as people's beliefs about the usefulness of flow. Based on the findings presented in this study, flow metacognitions were defined as people's awareness of and beliefs on flow and its consequences and the strategies for

achieving and maintaining flow. Furthermore, the identified constructs formed the basis for the quantitative research studies presented in subsequent chapters.

2.3 Introduction

Metacognition was defined as 'stable knowledge or beliefs about one's own cognitive system, and knowledge about factors that affect the functioning of the system; the regulation and awareness of the current state of cognition, and appraisal of the significance of thought and memories' (Wells, 1995, p. 302). In its essence, flow could be conceptualised as a predominantly cognitive state of optimal functioning. It was therefore postulated that metacognitions about flow would comprise any beliefs people might hold on this cognitive state, in terms of knowledge about both the antecedents of flow (such as facilitating factors and the self-regulation of this state) and the consequences of flow. Although metacognitions in the context of flow had not been defined, Jackson & Csikszentmihalyi (1999) highlighted the importance of the 'mental factor' in flow and described flow as a state that could be achieved 'through control of the mind – or attention' (Jackson & Csikszentmihalyi, 1999, p. 16). Although they stated that 'it is not possible to make flow happen at will' (p. 138), achieving flow through 'control of the mind' seemed to allude to the potential of self-regulating flow experiences. The self-regulation of flow appeared to be particularly relevant in the context of sport, as Jackson and Csikszentmihalyi (1999) further noted that 'athletes vary widely in their responses when they're asked about whether flow is controllable. Some view it as a lucky occurrence, others as a state well within their reach and one they can count on happening' (p. 138). This statement highlighted potential individual differences in people's knowledge of the controllability of the flow state, at least in the context of

sports. The following account by a triathlete highlighted the 'controllability' of flow further:

> I think you can set it [flow] up. You can set the scene for it with all the preparation. It should be something that you can ask of yourself and get into, I think, through your training and through your discipline, because you have to be the one that reads your body. (Jackson & Csikszentmihalyi, 1999, p. 138)

Furthermore, previous research in the context of positive psychology reported on the adaptive function of general adaptive metacognitions for coping with demanding situations. Beer (2011) conducted interviews with highly self-regulated individuals with the aim of shedding light on metacognitive factors that aided coping with demanding situations. In order to understand how the interviewees used adaptive metacognitions to cope, they were asked to specifically recall demanding encounters. Flow, however, could be regarded as a cognitive state that predominantly occurs during the enactment of a demanding task. It would, therefore, not be necessary to specifically elicit people's recollection of demanding events. A demanding situation, and a person's skills to adequately cope with its demands, was found to be one of the core prerequisites of flow experiences (e.g. Fong et al., 2014). Rather, based on people's descriptions of flow, it should be possible to learn more about any knowledge and beliefs they may hold about flow. Therefore, the principal aim of this study was to understand whether people held metacognitive beliefs on flow based on the identification of instances of such constructs from qualitative data analyses.

2.4 Method

A two-part qualitative study was conducted. First, archival Flow Questionnaires (FQ, Csikszentmihalyi & Csikszentmihalyi, 1988) of a sample of

371 highly educated workers, including 261 flow-ers, were analysed for their qualitative content on questions relating to the activity in which they were engaged when experiencing flow, how the flow state started, how it felt during the activity, and how they kept the flow experience going. Second, semi-structured interviews were conducted with 12 highly educated British workers (one additional interview had to be excluded from the analysis due to problems with the recording equipment). It should be noted that the fact that workers were highly educated poses a potential limitation for the generalisability of the results of the qualitative analyses. Interview topics were aimed at eliciting people's experience of flow in work.

2.4.1 Participants and Procedure

The data used for the analysis were composed of a convenience sample of 371 workers who completed the FQ. The sample data were part of a larger archival dataset of FQs collected by Psychology Diploma students at London Metropolitan University. All projects received University Ethics approval, and all participants provided informed consent. The distribution of male (46%) and female (50%) workers was approximately equal (for four per cent this information was missing). The large majority were White (81%), just over five per cent were Indian and the remainder were of Black, Chinese, Mixed and Other ethnic origins. The sample included a wide variety of job types. The most frequently mentioned job categories were managers (23.2%), health specialists (16.4%), and administrators (16.2%). Eighty-four per cent worked full-time, and approximately 15% were employed part time. Just over half of the participants (50.4%) were female. The large majority of the worker sample experienced flow (70.4%). See Table 1.

Table 1: Demographics of UK worker sample

Demographics		Frequency	Percentage
Sex	Male	172	46.4
	Female	187	50.4
	Missing	12	3.2
Ethnicity	White	302	81.4
	Other	61	16.4
	Missing	8	2.2
Flow	Yes	261	70.4
	No	110	29.6
Job Category	Manager	86	23.2
	Health specialist	61	16.4
	Administrator	60	16.2
	Consultant	23	6.2
	IT specialist	23	6.2
	Investment banker	20	5.4
	Commercial trader	16	4.3
	Researcher	15	4.0
	Miscellany	63	17.0
	Missing	4	1.1

Note. N = 371

The sample of 12 interviewees was predominantly female (10 out of 12) and White (10 out of 12). All interviewees worked for the same UK-based company that provided training programmes to other organisations. Three of the interviewees were senior managers (i.e. director level); the remainder were at the junior management or administrative level (e.g. programme manager, assistant, and administrator). All interviewees experienced flow and were able to describe instances of flow during their work. Initial approval was sought from the organisation's Human Resources department to gain access to interested individuals. Emails detailing the project, including confidentiality of interviews, and contact details for the researcher were sent out centrally to staff by the HR administrator. Any further correspondence was directly between interested participants and the researcher. Interviews were set up at the participant's convenience and were held in one of the organisation's meeting

rooms. The study received University Ethics approval, and all participants provided informed consent (see Appendix 1).

2.4.2 Materials

Flow Questionnaire (FQ): The FQ asked participants if they recognised distinct quotes that described the flow state (Csikszentmihalyi & Csikszentmihalyi, 1988; Delle Fave & Massimini, 1991):

> My mind isn't wandering. I am totally involved in what I am doing and I am not thinking of anything else. My body feels good … the world seems to be cut off from me … I am less aware of myself and my problems.
>
> I am really quite oblivious to my surroundings after I really get going in this activity. I think that the phone could ring, and the doorbell could ring, or the house burn down or something like that … Once I stop I can let it back again.

The FQ usually has been used to assess the prevalence of flow across people and situations. However, it also included the following open-ended questions that referred to the experience of flow: 'When does it happen during the activity?'; 'How does it feel?'; 'How does this feeling get started?'; 'What do you do to get it started?'; 'Can it happen anywhere, anytime?'; and 'What keeps it going once it starts?'. Respondents were free to describe flow experiences during everyday activities, including work and leisure activities. As flow metacognitions had not been described in the literature, the nature of this study was exploratory. The open-ended questions in the FQ were chosen because they were not leading with regards to people's reflections on cognitive processes involved in flow experiences. As participants were not specifically prompted to reflect on any potential flow specific metacognitions, they were, therefore, able to describe a wide range of components of flow experiences as well as metacognitive insights.

Semi-structured Interview: **Semi-structured interviews were held with a sample of 12 professionals (see**

Appendix 2) and focused on the interviewees' flow experiences at work. The interview started by the participants reading the quotes of the FQ and asking them if they recognised these experiences in the context of their work. All participants recognised flow and were able to give accounts of one or a number of specific work activities during which they experienced flow in the past. The aim was to understand if people had any metacognitive knowledge of flow as well as potential strategies for eliciting and sustaining flow. Therefore, the question focused on their feelings prior to and during flow ('Before you get into flow, how do you feel?'; 'When you are in flow, how does it feel?'); possible knowledge of when the flow state was likely to happen during the activity ('When you carry out an activity, when do you get into flow?'); as well as more general beliefs about the possible adaptive and maladaptive functions of being in flow ('Is there anything positive about this state?'; 'Is there anything negative about this state?'; 'Does being in flow have any effects on the quality of your work?'). In addition, questions were asked about the potential strategies they employed to achieve and maintain flow ('Do you do anything to get into this state, to stay in this state, to end this state?'). The interviews were tape recorded with the permission of the participant and lasted approximately 30 minutes.

2.4.3 Qualitative Data Analysis

The data were coded into broader themes based on thematic analysis (e.g. Braun & Clarke, 2006). However, the approach to coding was not guided by the identification of themes most commonly mentioned in the data. Rather, the analysis was guided by coding those themes that, informed by the literature on metacognition and flow theory, would shed light on flow specific metacognitions. To this effect, the

aim was to record new insights into flow as a cognitive state that would go beyond the description of the already widely recognised components of flow. Therefore, a theory-led approach to thematic analysis, as proposed by Hayes (1997), was adopted that emphasised the 'keyness' of identified constructs rather than their frequency. This approach had also previously been successfully employed to identify instances of adaptive metacognitions (Beer, 2011; Beer & Moneta, 2012a). The analysis followed the six principles for thematic analysis suggested by Braun and Clarke (2006), albeit focusing on keyness of themes. This included familiarisation with the data by transcribing and repeatedly reading the transcribed material, generating preliminary codes, identifying overarching themes within the codes, reviewing themes, labelling the themes, and finally concluding by writing-up the findings. The analysis focused on the identification of themes that fell under the following broad research questions with regard to potential metacognitions of flow:

- Did people have knowledge (i.e. held certain beliefs) about the conditions under which they could experience flow?
- Did people hold any beliefs regarding the control of flow experiences (as it had previously been reported in samples of athletes)?
- Did people have any beliefs with regard to the potential positive consequences of flow, particularly in work contexts?

The act of coding was facilitated by NVivo qualitative data analysis software (2008). Codes, or 'nodes', as labelled in NVivo, were produced by identifying and marking relevant sections in the transcribed text, that were imported into the NVivo interface. Similar themes and sub-themes were grouped under the same node, although 'keyness' was important with regard to those research questions rather than the number of mentions of a particular theme.

2.5 Findings and Discussion of Qualitative Studies

Based on the qualitative analyses, a range of concepts emerged. In order to describe these fully, findings and discussion were combined. Extracts from the FQs and the semi-structured interviews (where relevant) were also presented in conjunction.

2.5.1 Metacognition of Flow – Are People Aware of Flow Experiences?

One of the main advantages of the FQ was that it did not impose the experience of flow on participants as the standardised, componential questionnaires did (Moneta, 2012b). Participants were free to choose whether or not they recognised the experience described in the quotes of the FQ. Over 70% of respondents (70.4% of the total 371 participants) stated that they recognised the definitions of flow as presented by the FQ. The remainder did not experience flow. They may have either never been in flow, or had experienced flow but lacked awareness and did not associate this experience with the definitions provided in the FQ. The majority of people reported having flow, either during work or their leisure time. They recognised the cognitive process of flow that could be interpreted as an elementary level of awareness of the flow state. Broadly comparable findings, also based on the FQ, were reported in the past. For example, research by Bassi, Steca, Monzani, Greco, and Delle Fave, (2014) reported a prevalence of 66.4% experiencing flow based on a sample of 408 Italian teenagers.

2.6 Knowledge of Flow Eliciting and Sustaining Strategies

A number of people reported different strategies that facilitated entering flow and also gave examples of strategies that facilitated keeping the flow experience going during the activity. Most accounts revolved around the ***theme of minimising***

distractions. Respondents either tried to minimise interactions with others by avoiding or ignoring colleagues or family members while conducting the work activity, e.g.:

> [What keeps it going once it starts?] Not being interrupted and everyone knowing this is my focus for the day. (FQ, female, manager)
>
> [How does this feeling get started?] When things are going well and when distractions are few. I tend to let others into my work too much, and the 'things are going well' feeling comes as deadlines and urgency approach, and I ignore interruptions from others. (FQ, gender unknown, manager)

'Self-inflicted' distractions were minimised by those who reported that the organisation of their workspace prior to the activity helped them avoid unnecessary interruptions later on, e.g.:

> I prepare myself for my studying session. This usually involves making sure I am comfortable and have everything I need so I won't have to interrupt the session and break my concentration. (FQ, female, consultant)
>
> I try to 'clear my desk' so that there are no distractions. (FQ, male, IT specialist)

In addition to blocking other people out, some described the 'need to concentrate and block out other everyday matters' (FQ, male, manager). A detailed account of all of these processes in combination was given by a participant who was asked to describe how she entered into flow:

> I order the things I need around me, prepare my computer and start looking at my notes and do not do anything else. I even ignore [items on the] desk or mobile phone. I put on headphones and play music (different types but usually upbeat). (FQ, female, learning advisor)

Similarly, interviewees also reported on their strategies for the facilitation of flow at work, particularly by the creation of some order, or the scheduling of important work

for early in the morning so that they could fully concentrate and become engrossed in the activity:

> [Do you have any strategies for getting into this state?] I need to have some sort of order, I need to tidy the desk or make a list or I need to orientate in some way. (Interviewee, female, executive)
>
> [Do you have any strategies for getting into this state?] Any piece of work that I know will be quite difficult, I will tend to do it in the morning because of the concentration needed. (Interviewee, female, accountant)

Furthermore, other interviewees described how they would get interrupted at work, e.g. by phone calls or colleagues, and how they would re-enter the flow experience:

> [What would interrupt being in flow?] Maybe a phone call or other people, things like that. I mean I'm ok with that I can jump back into it quite easily if there is obviously the motivation. (Interviewee, female, administrator)

Although this interviewee continued to report that she did not have any strategies for entering flow, she still had the knowledge that she was able 'jump back into flow' after interruptions with relative ease:

> [Do you have any strategies for getting into this state?] I don't have any strategies. I think I kind of get back into it and just do it from where I've left off. I don't think I really have to go back to the beginning, wherever I left off I can start again. (Interviewee, female, administrator)

In contrast to the previous account, the following interviewee was able to describe her strategies for getting into flow in more detail:

> Well I have everything made out. I have all the application forms and all the spreadsheets that I need. I do that and then it's just a question of starting and working through systematically. I suppose where I am even more focused, I suppose consciously focused, is when there is something I'm not familiar with. I had to keep reminding myself these are the steps to go through. (Interviewee, female, finance assistant)

In addition to minimising interruptions, another theme, with regard to people's knowledge on the factors facilitating their experience of flow, was people's ***knowledge of environmental effects.*** Although a large number of respondents (based on the analysis of FQs) felt that flow could happen 'anywhere', for some, the environment seemed to play a central role as some stressed the importance of specific locations to their experience of flow. Based on studies of flow in sports (e.g. Kimiecik & Stein, 1992), it was not surprising that situational factors were very important to experiencing flow as certain activities could only be carried out in a specific environment (e.g. the football pitch, gym, etc.). Some respondents, however, who could have carried out the activity in a number of places, made it clear that flow could only happen when they were in a familiar environment such as the privacy of their own home or a 'relaxed place' which could partly be related to the theme of minimizing distractions. The following accounts illustrated this theme based on the question: 'When does it [flow] happen?'

> When I am in a comfortable relaxed place. (FQ, male, researcher)
>
> It can potentially happen anywhere, particularly with a really good book. However, I'm less likely to totally relax when I am in a public place rather than at home. (FQ, female, administrator)
>
> This only really happens when I am at home on my own and have total peace and quiet. (FQ, female, consultant)

The statements based on the FQ analysis appeared to be mirrored by two accounts of an interviewee, she reported that flow could happen anywhere with the caveat that distractions would be detrimental to more mentally challenging activities such as reading or writing. In addition, she provided an outline as to how working at home enabled her to get into flow, particularly during the evening hours of the day, and also linked the experience of flow to a positive consequence, i.e. being creative.

> [Can flow happen anywhere, anytime?] Yes, it can happen anywhere that [I] could be on the phone, I was travelling on the train the other day, so that could happen there. I think the writing of stuff or reading is more difficult when distractions are around. (Interviewee, female, manager)
>
> [When would you get into this state?] My process would be, if I was working at home I might well be doing domestic things while I am working at home. I might be just pottering around, tidying up, because the thought process is going through my mind, and this is almost if my mind has sorted them out and once I've got my thoughts clear, then I am getting them all down on paper and then you are cutting and pasting and you are thinking, right if I do this. And it's more likely to be late at night for me. (…) That would be my most creative time. (Interviewee, female, manager)

Furthermore, the qualitative data showed interesting inter-individual differences regarding people's ***knowledge of the onset of flow***. The data were broadly categorised into three groups: The first group reported that they achieved flow immediately when they engaged in the activity; the second group required a 'warm-up' phase of varying length, and the final group appeared to have no control over the process. For them the flow state seemed to happen 'randomly'. For a number of people, flow happened immediately when the task started, as the following respondents described it ('When does it [flow] happen?'):

> Switches on almost immediately after I start reading. (FQ, male, consultant)
>
> [It starts] almost immediately. (FQ, female, administrator)
>
> Instantly I hit a snag, it starts by itself, the task becomes immediately absorbing. (FQ, male, IT specialist)

These narrative accounts could be interpreted in two different ways; either the person was instantly absorbed because of the flow conducive characteristics of the task or had access to strategies for the achievement of flow almost immediately after starting the task. The relative immediacy of the flow experience emerged also from the following interview account where the interviewee reflected on when she would get into flow at work. However, in addition to the knowledge that she could

achieve flow relatively instantly, she also elaborated on the interruptions she had to overcome and her strategies for doing so.

> [When would you get into this state?] In the sort of start-up phase. (…) The trouble is, I get interrupted all the time, so it's very difficult. So what I am doing in my mind is taking myself in my study at home, when there is no one else in the house and I am trying to get something done and that's when I am fully involved and therefore I would say that I am in that state all through the activity. (Interviewee, female, executive)

In contrast to those who experienced flow very rapidly, the data also revealed that a number of people were aware that, for them, a warm-up phase was required to get into flow. This phase usually took from a few minutes to longer periods, with some accounts being very specific as to the length of time, e.g.:

> [Flow happens] usually about 20 min in[to the activity]. (FQ, female, manager)
>
> After a few minutes of focusing on the task/activity. (FQ, male, manager)
>
> Never at the start, but when I get engrossed with designing a pattern or product. (FQ, female, artist)

A number of respondents were able to identify flow experiences, but for them, as one participant noted, it 'just happens without any specific action' (FQ, male, manager). For this group, flow was a random experience and, as one respondent put it, she is not consciously aware of how flow started, but was aware of having been in flow based on its after-effects ('I don't consciously notice it, but am aware of a "high" and afterwards I am buzzing.' FQ, female, teacher). Interpreting flow as random in nature could also be viewed as having a lack of awareness of the onset of flow (i.e. an inability to ascertain when or how it can happen), and was illustrated by the following accounts:

> I don't really know, I lose myself in what I'm reading so am unaware of what's going on, and I'm not really thinking about the experience, just what I'm reading. (FQ, female, consultant)
>
> I feel physical and emotional sensations, but I don't do much consciously to get it started. (FQ, male, health specialist)
>
> Starts on its own, it can be impulsive and can happen anywhere. (FQ, gender unknown, engineer)

Overall, the analysis revealed potential inter-individual differences in the self-regulation of the experience of flow, for those who recognised this state. Some participants appeared to actively seek and 'create' flow for themselves by employing a range of strategies to get into flow and to keep flow going, such as choosing a flow conducive environment, and engaging in cognitive self-regulation. The reports of others illustrated that to them, flow appeared to be happening at random.

2.7 General Beliefs about Flow

Furthermore, more general beliefs regarding the experience of flow emerged. Given that participants were not prompted to describe their beliefs regarding flow, these predominantly referred to some of the antecedent and components already well known based on the literature of flow theory. For example, one of the sub-themes was related to people's ***belief on (positive) emotions*** in the context of flow that one would have to be in a positive ('right') frame of mind to experience flow, (e.g. 'It doesn't always happen. Need to be in the right frame of mind.' FQ, female, manager), as well as the importance of positive emotions in sustaining flow ('Staying positive and enjoyment in what I am doing.' FQ, male, consultant). This link between positive emotions and flow has been well documented (e.g., Massimini et al., 1988), but predominantly in terms of the positive after-effects of flow. In addition, a theme with regards to people's beliefs about the effects of ***deadlines and pressure*** also emerged from the data, with inter-individual differences in people's

beliefs about the impact of these factors on their experience of flow. Participants appeared to hold either positive or negative beliefs about the importance of looming deadlines or pressure for achieving the flow state. In particular, it seemed that pressure facilitated focused attention on the task. For some, this appeared to be almost a necessary condition for experiencing flow, with one respondent suggesting that pressure facilitated task focus:

> [When does flow happen] Time pressure and a high level of interest. (FQ, female, administrator)
>
> [When does flow happen] I would need to feel challenged and absorbed, so that my mind is working quickly to keep solving problems, keep performing better. It is partly a response to pressure. I don't often find the same flow if I am not being asked to perform. (FQ, female, artist)

However, others held negative beliefs about a link between pressure and flow, and illustrated that pressure was detrimental for achieving flow:

> [It feels] ok unless there are time pressures, this feels stressful. (FQ, male, technician)
>
> [Flow] usually happens when I am relaxed and there is no pressure on me and when I am happy. (FQ, female, health specialist)

These beliefs on flow have not been pursued further as separate components in subsequent chapters. In particular, people's beliefs about pressure in terms of the facilitation and hindrance of flow appeared to tap into individual difference dimensions in the self-regulation of the perceived demands of the activity and perceived skills to handle these demands. Furthermore, people's beliefs regarding positive emotions facilitating flow also appeared to tap into knowledge of aspects (i.e. positive emotions) implicated in the self-regulating of the flow experience. Overall, as described earlier, these components appeared to be part of a broader,

general component relating to people's self-regulation capabilities in eliciting and sustaining flow.

2.7.1 Beliefs about Usefulness of Being in Flow

Another theme that emerged focused on people's beliefs regarding the positive consequences of being in a state of flow, particularly in work situations or contexts in which deep concentration and cognitive efficiency were required. The following quote explained very well the respondent's awareness of the usefulness of being in flow for the completion of the job: 'I tend to stop when the inspiration fades out. But the experience learned me (sic) to continue and finish the job.' (FQ, male, administrator). Also, examples from interviewees about their reflections on the timing of flow at work illustrated their beliefs regarding the usefulness of this state:

> [When would you get into this state?] When I need to move into a creative or preparation phase, like writing reports or thinking about the next thing to do or pulling things together, then I can really concentrate. Or when I am sorting out a problem then, yes. Those, when I am creating something, when I am pulling things together to work for the next phase or when I am sorting a tricky problem that has multiple strands to it. (Interviewee, female, executive)

> [Is there anything positive about being in this state?] For me it's when I make my breakthroughs. It's when I move things to a shaped level. I work in diagrams and models, I think big picture, I am a very linking thinker, which is very tiring, and when I pull things together. Something usually comes out of it, and I've made explicit to myself what I am thinking. And that means I can then go away and act. (Interviewee, female, executive)

Others showed awareness that while in flow, they were able to increase their task focus, make connections, and generate various ideas, and that they would also be more creative when in flow:

> [When does flow happen?] For me, it's normally when I'm on my own, sat at the computer, often with no idea of what I will produce, once I start to draw, the ideas just flow, and then I can create, and it feels great. Once I start getting ideas, they run and run, turning into other things, I often

> find I have too many ideas to capture them all and sometimes feel like I could sit there forever just churning them out! I have to stop to sleep. (FQ, female, artist)
>
> [When does flow happen?] The most intense moments are after I've settled into the work, found my feet and managed to hold the problem at hand completely in my head. Then when you let your mind wander around the topic, you start to make connections with other things. (FQ, male, IT specialist)

Furthermore, interviewees elaborated that they would be more productive when in flow and would get their work done faster.

> [Is there anything positive about being in this state?] I suppose the way I feel is that I realise that, because you're in flow, the work gets done in a way faster. You think oh you've actually done a lot today. (Interviewee, female, finance assistant)
>
> [Is there anything positive about being in this state?] I think it is good for me, it just keeps me focused and I can get a lot done. It is quite surprising how much you can get done when you're concentrating. Apart from that no. (Interviewee, female, accountant)

This final quote also illustrates how the autotelic nature of the flow experience (even in the context of work) almost fuelled this interviewee to see the task through.

> Once you are in it, when you've started the flow, there is something like, yes, I can do this and I can get through it and you can actually see an end. And I might say I can actually get this done by a certain time or I am not going to stop until I completed this. (Interviewee, female, manager)

Overall, people were found to hold beliefs about the usefulness of being in flow, including increased task focus, productivity, efficiency, and enhanced creativity, as well as a drive to complete a work activity.

2.8 Flow and Coping

The previous sections supported arguments for people's metacognitive knowledge and strategies for the achievement and maintenance of flow. Yet, it was not clear if people used flow adaptively during (particularly) demanding situations.

Specifically, a theoretical link between adaptive metacognitions, which were found to facilitate coping efforts, and flow had been made based on both constructs being activated by demanding situations. Therefore, the qualitative accounts contained in the FQs were re-read with the aim of understanding whether being in flow could in itself be an adaptive way of coping with a difficult situation. As such, a person might use the flow state and enter flow in order to master a difficult situation. In order to shed light on this assumption, a sample of people was required who carried out professions in which situations of extraordinary difficulty were more commonplace. The qualitative extracts from the mixed professions sample who completed the FQ also included accounts of 47 medical staff and surgeons, which were part of a wider group of 61 healthcare specialists. Of these, just under half (22 people), reported having flow at work. Interestingly, the descriptions of their flow experiences stood out from the rest of the sample, both by the remarkable similarity of their accounts, and by the circumstances under which about half of these professionals described the experience of flow. In particular, they described experiencing flow during very demanding or stressful work-related situations, such as conducting surgery or dealing with difficult patient consultations. The other half experienced flow mainly during therapy sessions, more routine treatments, or assessments. Early on in flow research the work of surgeons was identified as particularly prone to eliciting flow, especially when the circumstances were right. The intensity of flow during surgery was being compared to the one experienced by artists and sportsmen (Csikszentmihalyi & Csikszentmihalyi, 2000). It was, therefore, not surprising that surgeons and medical staff in this sample also showed an acute awareness of the flow state.

Some preliminary evidence supported the fact that flow may have been used as a way to cope with difficult situations and that flow was a necessary condition for performing well. Despite flow being characterised as enjoyable, the medical staff showed signs that while in flow, they appraised the situation as stressful or challenging, with some vividly describing a range of negative physical symptoms and emotions while in flow. Some experienced a state of anxiety, with accompanying physical symptoms of sweating and increased heart rate (e.g. [How does it feel?] 'high anxiety and increased heart rate and intense'; 'It feels like my heart beats faster and my hands become a bit sweaty!'; 'I feel a sense of empathy, anxiety and a real need to problem solve'). Others, however, described the feeling as 'exhilarating' and another respondent described his state just before an operation as being 'calm'. These discrepancies could potentially be attributed to different levels of expertise or experience. However, similar to an actor just before entering the stage, some might have experienced a level of anxiety before performing an operation. This finding was also supported by the transactional model of stress (Lazarus & Folkman (1984), which proposed that situations could elicit both threat and challenge appraisals and one could 'shift' between the two. As Lazarus and Folkman (1984) commented, 'threat and challenge appraisals are not mutually exclusive' (p. 33). Despite their emotions and physical symptoms, the medical staff seemed to by entering flow almost automatically ([How does the feeling get started?] 'In my fingers and head and I bring my focus onto the task like being sucked into a television.' 'The feeling gets started physically through my heart beat and stomach and then somewhat directs my thought processes. To get it started I focus my gaze and my hearing directly on the people involved.' 'It is a spontaneous feeling that starts as soon as I am "in action".'). The accounts partly described the flow

facilitating mechanisms of the task they were performing as well as people's ability to self-regulate the onset of flow, predominantly by focusing their attention on the task at hand. Further, their accounts emphasised their beliefs about the usefulness of being in flow to perform their job as best they could and how best to deal with a difficult situation. As one surgeon commented, flow was kept going by 'the procedure which can be a matter of life or death' and the 'professional desire to succeed at the task'. Another one commented that flow was kept going by 'the need to do a perfect job'. Overall, some preliminary evidence was presented that flow could be activated as a mechanism to cope with demanding situations. Furthermore, people's metacognition on the positive consequences of flow for their work was reported.

2.9 Study Limitations

The qualitative findings presented in this chapter need to be viewed in the context of their exploratory nature and, therefore, inherent limitations. Rather than focusing on the quantity of the instances in which potential flow metacognitions were mentioned, the analysis focused on the 'keyness' of potential constructs. In addition, it should be noted that there might have been other metacognitions related to the flow that were not captured by this analysis. Furthermore, instances in which people used flow as an active way to cope with a demanding work situation were limited. There could be a number of possible explanations. First, participants were not specifically asked to reflect on particular beliefs they held regarding flow, nor were they asked to comment on whether they employed flow as a strategy for coping with stressful situations. Second, as a coping strategy, flow may only occur in extreme events, which might generally be rare occasions but more frequent for certain professions, such as the medical staff described here. Third, and related to the

preceding point, is the circumstance that the FQ, from which the data were drawn, asked to focus on those experiences where flow was most salient. Therefore, flow which was experienced during demanding or stressful encounters could not be as readily recalled as situations or activities during which flow occurred more regularly.

In addition, with regard to the identified themes, the researcher's knowledge on the subject matter and her own beliefs on flow may have played a role in guiding the coding process. In particular, holding certain beliefs on flow might have made these more salient in the data during the process of reading the narrative accounts and coding them. Therefore, the identified constructs were discussed with the PhD supervisor to have a more objective sounding board of the analytical process, albeit some level of subjectivity cannot be discounted.

2.10 Conclusions

The qualitative analysis provided initial evidence for individual differences in potential metacognitions on flow, i.e. the knowledge and beliefs people have about flow as a cognitive state as well as any strategies people use to achieve flow. While flow was not necessarily recognised as a controllable state by all, some appeared to have knowledge of the factors which facilitated flow (e.g. environmental and task specific factors) as well as more specific skills in self-regulating their flow experiences (e.g. removing distractions, focusing attention). A number of participants appeared to actively seek and 'create' flow for themselves, such as choosing or creating a flow-conducive environment (e.g. by ordering their workspace, removing distractions, or going to a place of which they know it enables them to get into flow more easily). Also, some of the interviewees recognised that a particular environment, not necessarily their workplace, was conducive to their

experience of flow. Furthermore, the qualitative analysis revealed potential individual differences in terms of the self-regulation of the experience of flow. Some described how they engaged in cognitive self-regulation, for example by consciously focusing on a task at hand when they felt that they might be exiting flow, or by breaking a task into more manageable sub-tasks. Cognitive self-regulation could be seen as an intrinsic part of flow theory as described by the following excerpt by Nakamura and Csikszentmihalyi (2005). It detailed the process of monitoring and control of cognition while in flow.

> Being 'in flow' is the way that some interviewees described the subjective experience of engaging just-manageable challenges by tackling a series of goals, continuously processing feedback about progress, and adjusting action based on this feedback. (…) Experiencing anxiety or boredom presses a person to adjust his or her level of skill and/or challenge in order to escape the aversive state and reenter flow. (p. 90)

The data suggested that some people were indeed aware of the conditions of flow and could make flow happen. For others, flow remained a more 'random' experience that just happened to them unnoticed, although they were still able to recall the positive after-effects of flow. There was also preliminary evidence that respondents held both positive and negative beliefs about the importance of deadlines or external pressure for achieving the flow state as well as positive emotions prior or during flow. While for some pressure appeared to be a necessary condition, for others it was found to be detrimental to achieving flow. However, these two factors appeared to be captured by a wider individual difference factor related to the self-regulation of flow. In addition, people held a range of interesting beliefs about the positive consequences and usefulness of being in flow. Furthermore, based on a sub-sample of FQs, a particular group of workers, surgeons and medical staff, appeared to have

utilised the flow experience as a way of coping with difficult, work-related situations.

Overall, two potential metacognitive factors of flow appeared to be especially relevant for further study. In particular, these were individual differences in people's ability to self-regulate flow experiences, which were most salient in the data as described by a range of concepts which fell under this broader category. In addition, people's beliefs about the usefulness of being in flow and its positive consequences was selected, as this belief in flow appeared to be particularly relevant for contexts of achievement, such as work or study. It would therefore be important to understand whether this factor and the self-regulation of flow had any effects on work-related flow. Based on the findings presented in this study, flow metacognitions could be defined as people's awareness of and beliefs on flow and its consequences, and the strategies for the achievement and maintenance of flow. Furthermore, the identified constructs formed the basis for the quantitative research studies presented in subsequent chapters.

Chapter 3: Methodological Considerations

Before moving on to the description of the quantitative studies presented in Chapter 4, 5, and 6, a range of considerations were given to the operationalisation of flow as part of this PhD research. The main models of flow and methodologies are reviewed briefly and discussed in light of the conceptualisation and measurement of flow as part of this dissertation. Furthermore, this chapter outlines the rationale for focusing the measurement of flow on the *Short Flow in Work Scale* (SFWS; Moneta, 2012a) as well as two other, well-used standardised measures of flow, the *Short Dispositional Flow Scale-2* (SDFS-2; Jackson et al., 2008), and the *Flow Short Scale* (FSS; Rheinberg, et al., 2003; Engeser & Rheinberg, 2008). It should be noted that the measurement of potential flow metacognitions was conducted with a new and bespoke tool, which was developed relatively independently of any existing models or components of flow. Flow in work was selected as the predominant context to study potential adaptive flow metacognitions, as flow was found to be most frequently experienced at work (e.g. Engeser & Baumann, 2016). In addition, conditions in work were reported to be more likely to give rise to demanding situations which would also call for the use of adaptive metacognitions in order to adequately cope with these demands. Furthermore, the study of flow in work might have important applications and consequences for people's well-being in achievement contexts. Therefore, the studies presented in subsequent chapters focused predominantly on flow in the context of work rather than leisure.

3.1 Models of Flow

As described in Chapter 1, a range of models for the prediction of when flow was most likely to occur were developed. These models were based on only one of

the components of flow, the balance of perceived challenges (or demands) of the activity and the perceived skills one has to address these demands. Two of these models, the quadrant and octant model, are depicted in Figure 1 and Figure 2. Depending on the interplay between the balance of perceived challenges or demands of the task and the perceived skills one has to adequately 'tackle' or cope with these demands, experiential positive or negative states could be attained. Based on these models, flow would only be achieved when a person perceived the challenges/demands of a task to be above the norm, e.g. in the context of work. This could be achieved in tasks that were less routine and more demanding than average tasks, by stretching one's skills to handle these demands, while still maintaining a relative equilibrium between skills and demands. If this equilibrium was out of balance (i.e. when challenges were perceived to be high and skills low, and vice versa), anxiety or boredom ensued. When perceived challenges and skills were both low a state of apathy would be experienced, as shown in Figure 1.

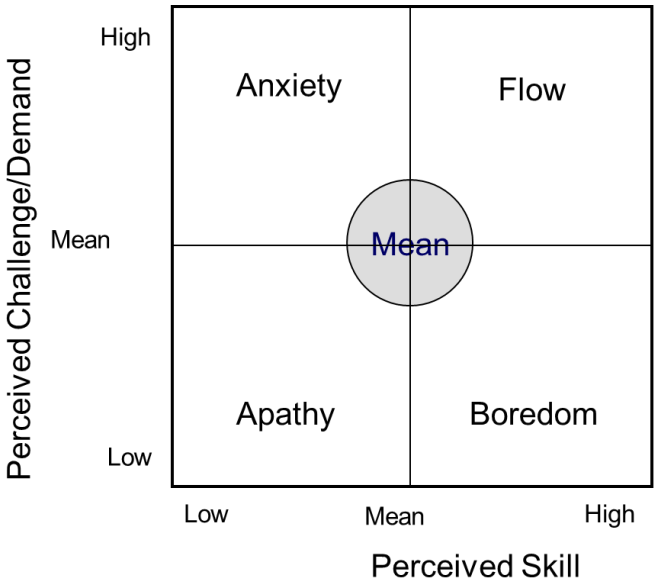

Figure 1: The quadrant model of flow (adapted from Moneta, 2012b, p. 33, Fig. 2.3, used with author's permission)

Yet, the quadrant model could be viewed as a relatively crude, and somewhat limited representation of the plethora of states that could be experienced. The extension of the quadrant model, the octant model (Massimini & Carli, 1988), which operationalised eight states based on the relative trade-off between challenges and skills is depicted in Figure 2. Now, rather than falling 'beyond boredom and anxiety', as predicted by the quadrant model, flow was a state between control and arousal.

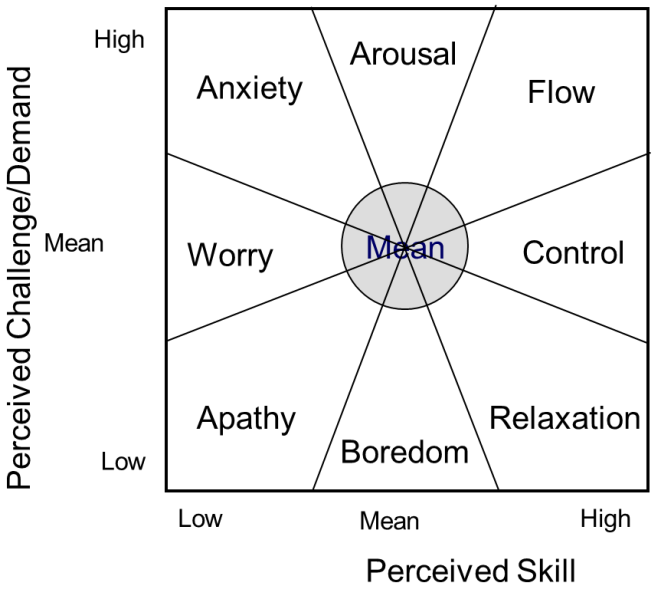

Figure 2: The octant model of flow (adapted from Moneta, 2012b, p. 35, Fig. 2.2, used with author's permission)

These models were developed based on ESM studies, with the balance of challenge and skill as the primary indicator for flow in daily life (Larson & Csikszentmihalyi, 1983). Although these models of flow were instrumental in furthering flow theory, and aided the explanation of one important antecedent of flow, a unidimensional operationalisation of flow appeared to be insufficient in fully conceptualising people's flow experiences. Therefore, in relation to this PhD

research, flow was regarded as a multifaceted, predominantly cognitive experience, which also needed to be reflected in its measurement. To this effect, flow was not operationalised based on the challenge–skill balance, which was considered an antecedent of flow, but rather based on those components which were deemed most relevant in operationalising flow as cognitive state (as described in the next section).

3.2 Questionnaire Measures of Flow Included in PhD Research

There has generally been a lack of consensus regarding the operationalisation of flow – as pointed out by a number of researchers in the field (e.g. Moneta, 2012b) – and the use of a variety of available approaches would be necessary to more fully understand the complexity of flow (Fullagar & Kelloway, 2013). Therefore, it was necessary to include a range of flow measures as part of this PhD research in order to corroborate any findings with confidence. In particular, flow was measured with the following four measures: The *Flow Questionnaire* (FQ, Csikszentmihalyi & Csikszentmihalyi, 1988; Delle Fave & Massimini, 1991), the *Short Flow in Work Scale* (SFWS; Moneta, 2012a), the *Short Dispositional Flow Scale-2* (SDFS-2; Jackson et al., 2008), and the *Flow Short Scale* (FSS; Rheinberg et al., 2003). Furthermore, this PhD research conceptualised flow as a predominantly cognitive state, with the aim of identifying and understanding how people think about this cognitive state, i.e. people's metacognitions on flow. The view of flow as a cognitive state was in line with flow theory, as outlined by Jackson and Csikszentmihalyi (1999). They described the nine components of flow as the 'FundaMentals' (sic) of flow, and pointed out that the spelling of 'FundaMentals' aimed to highlight the 'mental factor' in flow. They continued to describe flow as a psychological state and the importance of 'the mind-set that opened up the possibility for flow' and how 'one can achieve it [flow] through control of the mind – or attention' (Jackson &

Csikszentmihalyi, 1999, p. 16). Although these quotes focused on flow experiences in the context of sport, there was no theoretical reason why the experience of flow and the mental component of flow should have been different in any other context. A range of studies confirmed that the experience of flow was very much the same across different tasks or circumstances. To this effect, a measure of flow was included in the quantitative studies of this PhD, which was felt to successfully capture what could be considered the core cognitive components of flow, in particular, the centring of attention, merging of action and awareness, and loss of self-consciousness. These components were first included in the qualitative quotes presented in the FQ as described in Chapter 1. The FQ was used as part of this PhD research to distinguish between participants who experienced flow (flow-ers) and those who did not (non-flow-ers) as the experience of flow was deemed a necessary condition for people to be able to hold metacognitions on this state.

The *Short Flow in Work Scale (SFWS)* developed by Moneta (2012a) also captured these three core components. The quotes presented in the FQ were used as a template for the development of this brief, three item scale that included the flow components of loss of self-consciousness ('Sometimes when I am working I become so absorbed that I am less aware of myself and my problems.'), centring of attention ('When I get really involved in my work my concentration becomes like my breathing … I never think of it.') and, merging of action and awareness ('When I am working I am so involved in it that I don't see myself as separate from what I am doing.') (Moneta, 2012a, p. 494). The items were worded in a similar fashion to the Work Preference Inventory (WPI, Amabile, Hill, Hennessey, & Tighe, 1994), a measure of trait intrinsic and extrinsic motivation in the context of work. Items were scored on a 4-point scale (ranging from 1 'never or almost never true for me' to 4

'always or almost always true for me'). The SFWS could be used as a stand-alone measure or in conjunction with the WPI. The SFWS was found to have good psychometric properties, with the internal consistency as assessed by the Cronbach's alpha coefficient reported at .80, as well as good convergent and discriminant validity (Moneta, 2012a). For the purposes of this PhD research, the SFWS was used as the main measure as it had a number of advantages over other scales used for assessing flow. First, it was compatible with the FQ, yet instead of asking respondents to answer yes or no to qualitative descriptions of flow, it provided a numeric estimate of the three components of flow. Second, where the FQ assumed that respondents considered the components simultaneously when reading the quotes and provided an answer based on this consideration, the SFWS gave a quantitative score based on the average score of its components. It could also still be considered a multidimensional approach to the measurement of flow, as opposed to a unidimensional one, as it captured three of the nine identified components of flow. In addition, it did not include any of its antecedents (i.e. balance of challenges and skills, clarity of goals, and feedback) and, therefore did not confound antecedents with potential components or consequences of flow. It could also be easily administered due to its briefness.

The *Flow Short Scale* (FSS; Rheinberg et al., 2003) was developed as a ten-item measure for the assessment of flow in eight of its underlying components (with the exclusion of the autotelic experience as a separate item). The English version was based on an earlier German version (Flow-Kurzskala, FKS) by Rheinberg et al. (2003). Items for the measurement of flow included e.g. 'I have no difficulty concentrating' and 'I know what I have to do each step of the way'. The FSS scored people's agreement with the items on a seven-item scale (ranging from 0 – not at all,

to 6 – very much). In addition, the scale included three items that were not part of the measurement of flow and used to assess perceived task importance. Both a one-factor and a two-factor structure of the underlying components were statistically supported. The two-factors were labelled ‘fluency of performance’ and ‘absorption by activity’. The scale was found to have good psychometric properties and was successfully used in a range of contexts.

The short version of the dispositional *Flow Scale-2* (SDFS-2; Jackson et al., 2008) was a nine-item measure based on a longer 36-item version of the scale, that assessed each of the nine components of flow with one item. Items included e.g. ‘I am completely focused on the task at hand’ assessing concentration or ‘the way time passes seems to be different from normal’ capturing transformation of time (Jackson et al., 2008, p. 567). Agreement with the items was scored on a 5-point Likert scale, ranging from 1 (never) to 5 (always). This scale was found to have good psychometric properties and it was used extensively in the context of sport but its validity was also corroborated in non-sports contexts. The SDFS-2 was chosen because its psychometric properties better supported a global flow factor, whereas the long version statistically supported a nine-factor first order model. A global model of flow was also reported to be acceptable; however, two of the nine subscales were found to have weak factor loadings. Overall, as well as being easier to administer, the short nine-item measure was found to have better psychometric properties compared to the long, 36-item measure and was, therefore, used.

It should also be highlighted that all three measures shared one general problem: they assigned a numerical value to flow even if the person did not experience flow. However, this problem was addressed by first using the FQ, which identified people into flow-ers and non-flow-ers. Therefore, flower-ers subsequent flow scores on the

three componential scales were considered to be a reflection of people's intensity of flow as they had previously reported (based on the FQ) that they recognised flow experiences in their daily lives.

A range of other potential measures were not used in the context of this research. Some of these measures were not grounded in the widely recognised components of flow as identified by Csikszentmihalyi (e.g. Choi, Kim, & Kim, 2000) or were developed only for specific contexts such as flow in online environments (Novak, Hoffman, & Yung, 2000; Skadberg & Kimmel, 2004), with a detailed review of these presented by Hoffman and Novak (2009). Other measures focused only on selected characteristics of flow and usually included some antecedents as well as components of flow (e.g. Keller & Bless, 2007; Ullén et al., 2012). For example, as part of an experimental design, Keller and Bless (2007) operationalised flow by using a range of tools to measure its antecedents and components. In particular, perception of time was measured by asking participants to estimate the time they had spent in the experimental condition (i.e. playing a computer game) by marking their subjective experience of the passing of time on a 10cm line (with the scale description above the line ranging from 'very short' to 'very long'). Feelings of control were assessed by a bespoke 10-item scale for measuring people's control over the task outcome; task involvement and enjoyment were assessed with another bespoke measure that included 14 items and tapped into components of intrinsic enjoyment. Perceived skills and demand fit was based on one self-report item. Ullén et al. (2012) developed the Swedish Flow Proneness Questionnaire (SFPQ) and assessed the frequency of flow experiences in work, maintenance, and leisure activities. The items were partly based on the components identified by Csikszentmihalyi, (i.e. concentration, balance between skills and the

challenge of a task, clarity of goals, feedback, control, and a lack of a sense of boredom and enjoyment). The scale was also translated into English. Given the focus on flow in work in this dissertation, one measure in particular, the WOrk-reLated Flow scale (WOLF; Bakker, 2008), which operationalised the measurement of flow in work, appeared to be relevant. However, it was not used for two main reasons. First, the WOLF proposed a three-factor model of flow based on absorption, enjoyment, and intrinsic motivation and therefore deviated from the components of flow as identified by Csikszentmihalyi (2000). Second, and most importantly, the WOLF appeared to largely overlap with work engagement. Work engagement was based on three interrelated constructs, i.e. vigour, dedication, and absorption (Schaufeli, Bakker, & Salanova, 2006), as measured by the Utrecht Work Engagement Scale (UWES), whose factor structure supported a global work engagement factor as well as a three-factor model based on the three engagement factors. However, Fullagar and Kelloway (2013) criticised that 'both work engagement and the WOLF assess chronic involvement in a broad range of work activities, whereas flow is typically described as a more acute and intense absorption with a specific work task' (p. 450). Due to the WOLF's potential overlap with work engagement and lack of discriminant validity it was not included in the studies presented in this dissertation.

3.3 Flow: A State or a Trait?

Flow has both been conceptualised as a state and a general or domain specific trait. State and trait variables exhibited certain characteristics, and although people's distinction between them was found to have somewhat blurred boundaries, the 'prototypical cores' of both traits and states have certain characteristics (Chaplin, John, & Goldberg, 1988, p. 541). Traits would exhibit temporal stability,

consistency, and internal causation, whereas states were described by their briefness, temporal instability, and being caused by situational, external factors. Originally, flow was described as a state of intrinsic motivation predominantly experienced due to the flow conducive characteristics of a specific activity or situation. As such, flow as a state was assumed to be variable and situation dependent. Indeed, the initial focus of flow research was very much on the environmental properties that elicited flow, as the interviewees for Csikszentmihalyi's earlier studies were purposefully chosen because of the intrinsically rewarding nature of the activities they carried out (e.g. artists and chess players). However, viewing flow purely as a transient state entirely subject to situational circumstances would not do it justice, and indeed Csikszentmihalyi (2000) himself introduced the 'autotelic personality' to flow theory, an individual difference component, whereby some people possessed a proneness to experiencing flow more frequently and intensely. Based on the flow scales developed by Jackson and co-workers (i.e. the Dispositional Flow Scale and the Flow State Scale, Jackson & Eklund, 2004; Jackson et al., 2008) flow could be measured both as a state and a trait. Trait as well as state measures usually included the same items but varied in terms of the preambles to the questionnaire. As such, flow as a trait was measured by the participant's general tendency to experience flow within a specific context (e.g. work or leisure), whereas measures aimed at operationalising flow as a state were usually completed very shortly after a specific activity. To this extent, flow was similar to intrinsic motivation as well as work engagement, which were both found to have state as well as trait like characteristics (Moneta, 2014; Sonnentag, Dormann, & Demerouti, 2010). Yet, Fullagar and Kelloway (2013) commented on the fact that the distinction between flow as a state and as a trait was still a topic of debate. They also criticised that the distinction

appeared to have been made rather arbitrarily and based on the assumption that slight changes in the instructions of a questionnaire could change a 'respondent's orientation from state to trait' (p. 49).

However, it is important to outline how flow was conceptualised as part of this PhD research. Here it was measured as a disposition in the context of work, as this research aimed to tap into the construct of the autotelic personality: people's general proneness to experience flow. Therefore, it was important to establish the broader relationship between flow metacognitions and the autotelic aspects of flow (i.e. flow as a disposition) first, before the assessment of the specific underlying processes of flow metacognitions. Thus, the preambles to the measurements of flow asked participants to focus on the items with regard to their work in general (e.g. 'These questions relate to the thoughts and feelings you may experience during your work. You may experience these characteristics some of the time, all of the time, or none of the time. Think about how often you experience each characteristic during your work'). Once any relationships between flow metacognitions and flow were established, it would then open up the possibility of focusing more deeply on the underlying processes with the assessment of any potential impact on flow as a more fluctuating state. The subsequent measurement of the impact of flow metacognitions on state flow could be achieved by using e.g. ESM or end-of-day diary data analyses, which was outside of the scope of this dissertation. However, these approaches were outlined in the discussion section with regard to the research's implications for future studies.

3.4 Conclusions

In summary, a wide variety of tools for the measurement of flow have been developed. For robustness, four tools were selected because they were based fully (or partly) on Csikszentmihalyi's conceptualisation of flow. The main measure used, the SFWS, was developed relative recently and found to have good psychometric properties. It was based on the FQ (which was also used) and captured the components most related to conceptualising flow as a cognitive phenomenon. Two additional measures (i.e. the SDFS-2 and the FSS) were used extensively in flow research in a variety of context and were used as well. Furthermore, as outlined in the qualitative study (Chapter 2) the aim of the identification of flow specific metacognitions was not to replicate the nine antecedents and components of flow but to identify a new construct. Therefore, it is important to note that the development of the measure for potential flow metacognitions (as described in subsequent chapters) was undertaken largely independently of the componential approaches of flow as well as the challenge–skill based models of flow.

Chapter 4: Scale Development and Initial Scale Validation (Study 2)

4.1 Objective

The objective of this study was to develop a valid and reliable measure of flow metacognitions. This would be achieved by the development of a pilot questionnaire based on the potential metacognitive constructs identified in Study 1 (Chapter 2). The preliminary questionnaire items were tested on a student sample, and exploratory factor analyses were run to understand the underlying factor structure of the pilot questionnaire. Based on statistical and conceptual considerations, subsequent data reduction techniques were employed to reduce the total item count and establish an optimal number of items to be included in the final questionnaire. Study 2 was successfully concluded by the establishment of a final questionnaire, a tool that was both factorially sound and parsimonious for the measurement of flow metacognitions.

4.2 Chapter Summary

Flow metacognitions were defined in Chapter 2 as people's awareness of and beliefs about the flow state and its consequences, and strategies for achieving and maintaining flow. Based on the metacognitive constructs identified in the qualitative analyses described in Study 1, a pilot Flow Metacognitions Questionnaire (FMQ) was developed, and was tested on a sample of 204 UK students. Exploratory factor analysis of the 53-item pilot FMQ yielded a two-component solution. As is to be expected of a pilot questionnaire, many of these items were redundant. Item reduction procedures (i.e. visual inspection of the scree plot and item reduction via

the Hayes' Alphamax SPSS macro) identified that the most parsimonious and conceptually meaningful version of the FMQ contained 12 items.

Subsequent principal component analysis confirmed that the 12 items loaded onto two main components, each comprising six items. These subscales explained a total of 52.4% of the variance: 28.3% for subscale 1 and 24.1% for subscale 2. In concordance with the labelling of factors of adaptive and maladaptive metacognitions, these FMQ subscales were labelled Beliefs that Flow Fosters Achievement (FMQ-1) and Confidence in Ability to Self-Regulate Flow (FMQ-2).

4.3 Introduction

The qualitative analysis in Chapter 2 illustrated that people hold a range of beliefs about flow as a state of optimal functioning. As noted in the general introduction to the dissertation, reliable measurement of metacognition has been shown to be possible for maladaptive metacognitions and for adaptive metacognitions. Most notably, metacognitions have been found to have consequences; they are implicated in the persistence of a range of mental health problems, predominantly via pathological thinking styles that lead to maladaptive coping efforts. Metacognitions were also found to facilitate optimal functioning during demanding encounters and adaptive coping. Given the important influence beliefs have on cognitive processes, it is surprising that, to date, beliefs about flow have not been measured systematically. Although the measurements of metacognitions developed by Wells and also by Beer included constructs that were partially relevant to the measurement of flow metacognitions – e.g. the use of attention in the case of maladaptive metacognitions and people's confidence and flexibility in setting feasible goals in the case of adaptive metacognitions – these did not specifically measure people's beliefs about flow, and as such they might not be

an adequate measure for flow metacognitions. The development of a bespoke measure for flow metacognitions was thus called for.

The aim of this chapter is to present the development and initial validation of a scale measuring metacognitions of flow. A range of relevant flow metacognitive constructs emerged, based on the qualitative data analyses presented in Study 1 of Chapter 2, with two flow metacognitive factors of particular importance for the initiation, maintenance, and outcome of flow. These were selected for further investigation. First, participants who reflected on the flow state, attributed a 'usefulness' to being in flow, i.e. a belief that flow was related to achievement. Second, individual differences in the self-regulation of flow emerged as part of the qualitative analysis, with some participants experiencing flow as 'random events' while others expressed awareness of the conditions under which flow occurred for them and a belief that it could, at least partly, be initiated and self-regulated.

4.4 Method

4.4.1 Participants and Procedure

An opportunity sample of 305 students of London universities was recruited. The study received University Ethics approval, and all participants provided informed consent. Participants completed a series of questionnaire items including demographic information, the FQ and the pilot FMQ. Completion of the paper-and-pencil based measures took about 20 minutes. The sample's mean age was 26.0 years (*SD* = 6.4, age range = 17–62 years, age was unknown for five participants). Sixty-five per cent of the sample were female and 34% were male, sex was unknown for two participants. In addition to studying, just under half (44%) worked full or part time. A large majority of the sample were Caucasian (83%). The selected study sample for analysis comprised 204 students. The attrition in the sample occurred as

follows: Of the initial sample of N = 305, 93 (30.5%) did not experience flow, which is broadly comparable to other studies reporting prevalence of non-flow-ers based on FQ data (e.g. Bassi et al., 2014). 212 students experienced flow (69.5%) and had completed the 53-item pilot version of the FMQ. Of these 212, eight had completed the pilot FMQ with three or more missing questions. These were excluded from the analysis due to possible data-quality issues. A further 31 had missed completing one or two questions on the pilot FMQ. Inspection of the frequency of missing scores across the 53 items showed no systematic pattern, indicating that participants had missed questions randomly. In order to maximise sample size while ensuring data quality, missing values on only one or two questions were imputed via the expected maximisation (EM) algorithm in LISREL 8.8 (Jöreskog & Sörbom, 1996, 2006) for replacing missing values across multiple questionnaire items (Schumacker & Lomax, 2004). Results showed that there was no statistically significant difference in the mean scores on the pilot FMQ for the 31 participants with imputed values (M = 2.73, SD = .30) compared to the remaining 173 participants with no imputed values (M = 2.71, SD = .30); $t(202) = .48$, $p = .64$ (two-tailed), confirming that the imputation was adequate and successful. The resulting study sample comprised 204 students. The mean age of the study sample was 26.2 (SD = 6.8, age range = 18–62 years, age was unknown for four participants). Sixty-four percent were female and 35% male, sex was unknown for two participants. Furthermore, statistical analyses confirmed the adequacy of the sample selection, as there were no significant differences in demographics (age, sex, ethnicity, work status)[6] between the study sample (n=204) and the excluded participants (n=101).[7]

[6] T-test for independence was calculated to test for significant differences in age between the groups: $M_{included} = 26.2$, $SD_{included} = 6.8$, $M_{excluded} = 25.5$, $SD_{excluded} = 5.5$; $t(298) = -.83$, $p = .41$ (two-tailed). Chi-square tests for independence (with Yates Continuity Correction for 2x2 tables) were calculated for

4.4.2 Measures

Flow Questionnaire (FQ). The experience of flow was a prerequisite for the completion of the FMQ, and it was measured by a shortened version of the FQ. Participants were asked if they recognised the flow experience described by an abridged version of the quotes presented in the Flow Questionnaire (Csikszentmihalyi & Csikszentmihalyi, 1988; Delle Fave & Massimini, 1991):

> My mind isn't wandering. I am totally involved in what I am doing and I am not thinking of anything else. My body feels good … the world seems to be cut off from me … I am less aware of myself and my problems.
>
> My concentration is like breathing … I never think of it … When I start, I really do shut out the world.
>
> I am so involved in what I am doing … I don't see myself as separate from what I am doing.

Participants who recognised flow in their lives further described up to five specific work or leisure activities they were engaged in while in flow. Of these, participants were asked to select the *work* activity, which was most representative of the quotes, also known as the selected flow activity. Participants who did not report a work activity were to select a leisure activity. Measures on the frequency and time spent in flow were included in this version of the FQ. For the selected flow activity (i.e. SELECTED ACTIVITY), participants were also asked how often they had experienced flow ('How often did you have flow while you were doing the SELECTED ACTIVITY in the past twelve months?'; score range: 1 = a few times a year or less; 2 = once a month or less; 3 = a few times a month; 4 = once a week; 5 = a few times a week; 6 = every day), what percentage of time they experienced flow

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the included and excluded sample by sex (male vs. female): $\chi^2(1, n = 303) = .15$, $p = .61$; ethnicity (Caucasian vs. other): $\chi^2(1, n = 297) = .14$, $p = .23$; work status (work vs. no work): $\chi^2(1, n = 302) = 0$, $p = .99$. No statistically significant differences were found.

[7] Of the 101 participants, 93 did not experience flow and eight were excluded due to three or more missing values on the pilot FMQ.

('While you were carrying out the SELECTED ACTIVITY, for what percentage of times did you have flow?'; scores ranged from 1 = 1–10% to 10 = 91–100%), and how long the flow experiences lasted on average during a chosen activity ('While you were carrying out the SELECTED ACTIVITY and you had flow, how long did flow last on average in minutes?'). One of the main advantages of the FQ was that it did not impose the flow experience on respondents and let them freely choose whether they felt that they had ever experienced flow or not (Moneta, 2012b). It was expected that only people who would recognise flow and could report on their flow experience might also hold flow metacognitions. In the case of people who did not recognise flow, querying them about a state they had never encountered would be unlikely to provide relevant insights. Therefore, participants first completed the FQ and only those who identified themselves as flow-ers went on to complete the pilot FMQ.

Pilot Flow Metacognitions Questionnaire (FMQ). The FQ was followed by the preamble of the 53-item pilot FMQ (Appendix 3) which asked participants to read each item and imagine themselves while they were carrying out the activity. Items were scored on a 4-point Likert-like scale (1 = do not agree, 2 = agree slightly, 3 = agree moderately, 4 = agree very much). The preamble read as follows:

> *Please read each item and try to imagine yourself when you have flow while doing the selected activity. Please select one response per question which appears to be the most appropriate one for you.*

In line with the FQ, which had also used modified interview excerpts, the pilot items for the FMQ were predominantly constructed by adapting verbatim responses of participants' flow experiences as reported in Study 1 and also by constructing items informed by the literature on flow and metacognition. The aim of

the item selection was not to repeat the creation of a questionnaire measuring the frequency, components, or intensity of flow, but rather to deselect such items related to the components of flow as described by flow theory and focus on descriptions, which elicited people's beliefs about flow, the consequences of this state as well as any strategies for creating flow. For example, related to theoretical consideration regarding flow, Jackson and Csikszentmihalyi (1999) had previously commented that 'being able to convert the stressors into challenge becomes the key to flow' (p. 17) and empirically, qualitative research on flow in sports had found that a large proportion of athletes found flow controllable (Chavez, 2008; Jackson, 1992). Therefore, items were selected which specifically captured aspects of the self-regulation of flow. Standardization of item structure and response scale helped to reduce method effects in establishing the predictive validity of the new scale. This was achieved by using a similar 4-point response scale as used by Wells and Cartwright-Hatton (2004) for the MCQ-30 and Beer and Moneta (2010) for the PMCEQ. See Appendix 3 for the 53-item pilot FMQ.

4.4.3 Statistical Analyses

Exploratory factor analysis (EFA) was carried out on the 53-item pilot FMQ. Principal component analysis via direct oblimin oblique rotation was applied. The number of items per component was then further reduced based on a) the strength of factor loadings and b) submitting the items to Hayes' (2005) SPSS ALPHAMAX macro for composite measure shortening.[8] The advantage of this method over the 'iterative leave-one-out method' (Hayes, 2005, p. 12) was that the macro generated all possible subscales of two and more items. The iterative method, however, was

[8] The syntax for the SPSS and SAS macro ALPHAMAX is included in the Appendix of Hayes (2005).

based on a series of EFAs, each time deleting a questionnaire item until the Cronbach's alpha value of the resulting scale was maximised, which might result in missing the optimal item selection. The output of Hayes' macro could then be inspected for the subscales' internal consistencies (Cronbach's alpha values) and their correlations with the overall scale. An informed decision could then be made on the subscale which provided the most parsimonious solution, i.e. with the least number of items, while retaining face and content validity.

4.5 Results

4.5.1 Exploratory Factor Analysis on Pilot FMQ (53 items)

The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was .8 (above the cut-off value of .6) and Bartlett's Test of Sphericity (*Approximate* χ^2 = 4261.5, $p<.001$) was significant, indicating good factorability of the data and confirming that principal component analysis was appropriate to use on the data (Bartlett, 1954). The scree plot of the 53-item pilot indicated a two component solution. The total variance explained by both components was 27.5% (Component 1 = 17.1%, Component 2 = 10.4%). Component 1 captured the usefulness of being in flow, i.e. a belief that flow enabled achievement. Component 2, tapped into the belief of the self-regulation of flow and an awareness of the conditions under which flow occurs. Table 2 shows the pattern matrix for the 53-item pilot. Parallel analysis, carried out with a programme developed by Watkins (2000) that computes eigenvalues by performing a Monte Carlo simulation (generating 100 replications), suggested a four component solution. Simulated eigenvalues were smaller than actual eigenvalues for potential components 1 (simulated eigenvalue = 2.17), 2 (simulated eigenvalue = 2.01), 3 (simulated eigenvalue = 1.96), and 4 (simulated eigenvalue = 1.87). Appendix 4 includes a potential four-factor solution. This solution was not pursued further as the

percentages variance explained for both components 3 and 4 were relatively low and only a limited number of items loaded substantially onto these two components (i.e. only three and two items respectively had factor loadings of .5 or above).

Table 2: Pattern matrix for the 53-item pilot questionnaire (two-factor solution; direct oblimin rotation, N = 204) (continued on next page)

Questionnaire item	Component 1	Component 2
17. I become completely focused on the task when I am in flow.	**0.72**	-0.11
26. Flow has a positive effect on the activity.	**0.70**	-0.11
34. I know that by being in flow I achieve more.	**0.70**	0.04
28. My thinking becomes clearer when I am in flow.	**0.68**	-0.08
12. When I have flow I tend to get a lot done.	**0.67**	0.02
42. I find that I make more progress when I have flow.	**0.67**	0.02
36. I am able to generate various ideas and options while being in flow.	**0.66**	0.00
20. It is easy for me to generate ideas once I have flow.	**0.66**	-0.06
53. Finishing an activity during which I have had flow feels rewarding.	**0.63**	0.01
3. I am more creative when I am in flow.	**0.61**	0.04
35. I am not losing focus when I am in this state.	**0.61**	-0.04
19. Flow is more likely to happen when I am on my own.	**0.58**	-0.08
24. I tend to have my 'breakthroughs' when I am in flow.	**0.57**	-0.01
4. When I have flow, it feels as if my brain has fully 'warmed up'.	**0.57**	-0.08
10. When I have flow my thinking happens in a way where it is possible to make connections easily.	**0.54**	0.09
18. When I am in flow, I 'tune out' to what is around me.	**0.54**	-0.16
9. I feel confident and in control of what I am doing when I am in flow.	0.49	0.09
21. Flow usually happens when I've organised myself and my surroundings.	0.48	0.12
13. In order to have flow, I ignore interruptions from others.	0.46	0.24
50. I prefer tasks where I can have flow.	0.45	0.02
2. I get into flow once I have overcome an initial phase of 'wandering attention'.	0.44	-0.16
1. The activity has to be challenging otherwise I will not experience flow.	0.42	0.20
25. Flow seems to come up without me noticing such.	0.35	0.03
27. Without being in flow I feel that I am not fully processing information.	0.33	0.11
23. It usually takes a little while before I get flow.	0.33	-0.10
7. I try not to let my mind wander in order to keep flow going.	0.25	0.18
16. I don't do anything 'consciously' to maintain flow during the activity.	0.18	0.05
48. If the circumstances are not right there is nothing I can do to bring about flow.	0.06	0.03
40. I know how I can re-create having flow if I want to.	0.03	**0.68**
51. Once I start with the activity there is no stopping me	-0.09	**0.67**

Questionnaire item	Component 1	Component 2
getting into flow.		
44. When I come across a task which I don't particularly enjoy, I just make it more enjoyable in order to have flow.	-0.11	**0.67**
14. I am able to quickly re-enter flow if I need to.	-0.03	**0.64**
29. I can make an activity more challenging in order to have flow.	0.12	**0.62**
15. It is in my power to control when I have flow.	0.09	**0.59**
47. I know what I need to do to get into flow.	-0.07	**0.58**
39. I know that I have to look for a challenge to have flow.	0.15	**0.55**
33. I am able to sustain flow for long periods.	0.15	**0.54**
41. I can get into flow by setting myself goals.	0.16	**0.52**
49. I have flow when I've made a task more difficult.	-0.07	**0.52**
31. In order to have this experience I make a boring activity more interesting.	0.10	**0.51**
38. I am aware of the conditions that lead to this experience.	0.06	0.44
22. When I have this experience, I do not switch off until I have achieved what I set out to do.	0.30	0.40
11. I try to keep my mind 'fresh' in whatever way I can when I am in flow.	0.33	0.40
43. When I need to get the job done, I rely on my ability to have this flow.	0.29	0.38
5. Flow starts almost immediately after beginning the activity.	-0.03	0.37
32. I have ways of shutting myself off and maintaining flow when I am in a noisy environment.	0.15	0.36
30. When I am in flow I end up spending a lot of time without actually achieving much.	-0.35	0.36
52. I find it helpful to listen to music in order to get into flow.	-0.03	0.26
45. A noisy environment does not affect me having flow.	-0.01	0.23
37. I get side-tracked from what I have set out to do when I am in flow.	-0.14	0.22
6. It takes sustained effort to get flow started.	0.12	-0.14
46. There is no way of telling when I will have flow.	0.04	-0.11
8. There is nothing I do in particular to get flow started.	0.04	-0.05

Notes. Items (components 1 or 2 in bold) were further subjected to a scale reduction procedure. For illustrative purposes items included in the final version of the FMQ were highlighted in grey.

4.5.2 Survey Shortening

The pilot FMQ deliberately included a large number of items which would become redundant in the scale reduction process and were not included in the final version of the FMQ. Reduction procedures were therefore stringent, with items with

factor loadings of less than 0.5 on one factor or more than 0.2 on both factors being rejected. As expected, a number of items yielded weak factor loadings or loaded onto more than one factor (see Table 2 for pattern matrix). These items were eliminated as follows: Items 9, 21, 50, 2, 25, 27, 23, 7, 16, 48 (in descending order of loadings on factor 1) and items 38, 5, 32, 52, 45, 37, 6, 46, 8 (in descending order of loadings on factor 2) were taken out from the FMQ as their factor loadings were less than .5. Items 13, 1, 22, 11, 43, 30 loaded substantially onto two factors (.2 and higher) and were also excluded.

Items with factor loadings of .5 or higher on a factor and loadings of less than .2 on the other factor were further subjected to a survey shortening procedure based on Hayes' (2005) ALPAMAX SPSS macro. The use of the macro followed the steps outlined by Hayes (2005). The sample was randomly split into two halves, the development sample ($n_1 = 102$) and the cross-validation sample ($n_2 = 102$), by using the SPSS select random sample procedure. The development sample was first submitted to the macro. The data sheet, containing the resulting Cronbach's alpha values of all combinations of questionnaire item subscales with two or more items, was investigated. The analysis indicated that a six-item solution for factors 1 and factors 2 respectively would be most parsimonious and conceptually meaningful based on item wording, content, and Cronbach's alpha values.

The five subscales containing six items with the highest Cronbach's alpha values were then re-submitted to the macro, this time using the cross-validation sample. The results of the ALPAMAX analyses are shown in Table 3 and Table 4. Cronbach's alpha values are presented for the relevant subscale options based on the development sample and the cross-validation sample. All subscales showed good internal consistency as their Cronbach's alpha values exceeded the minimum of .70

(Nunnally & Bernstein, 1994) and could, in principle, have been chosen as the final scale(s) for factor 1 and factor 2. A decision was then made, taking conceptual considerations (i.e. the face validity and clarity of item wording) and internal consistency (Cronbach's alpha values of development and cross-validation sample) of the possible subscales into account, on the optimal items comprising the subscales for factor 1 and factor 2. For factor 1, the six items of option 5 (highlighted in Table 3) were selected, as this option had good Cronbach's alpha coefficients of .84 for the development and .83 for the cross-validation sub-sample and its items appeared most clearly worded and with the least redundancy in potentially tapping into beliefs about the usefulness of flow.

Table 3: Factor 1 – Cronbach's alpha values for five potential subscales (each containing six items) based on development (n_1=102) and cross-validation sample (n_2=102) with the chosen subscale highlighted in grey

Subscale	Analysed Items										Cronbach's Alpha	
	17	26	34	28	12	42	36	20	53	3	n_1=102	n_2=102
1	x	x	x	x	-	x	x	-	-	-	0.85	0.84
2	x	x	x	x	x	-	x	-	-	-	0.85	0.83
3	x	x	x	x	-	-	x	x	-	-	0.85	0.84
4	x	x	x	x	-	-	x	-	x	-	0.84	0.83
5	**x**	**x**	**x**	**x**	**-**	**-**	**x**	**-**	**-**	**x**	**0.84**	**0.83**

Note. 'x' denotes that the item was included in the subscale whereas '-' denotes that it was omitted.

The resulting optimal subscale for Component 1 comprised the following six questions:

- Flow has a positive effect on the activity. (Item 26)
- I am able to generate various ideas and options while being in flow. (Item 36)
- My thinking becomes clearer when I am in flow. (Item 28)
- I become completely focused on the task when I am in flow. (Item 17)
- I know that by being in flow I achieve more. (Item 34)
- I am more creative when I am in flow. (Item 3)

The chosen subscale for Component 2 (highlighted in Table 4) also comprised six questions, with Cronbach's alpha values of .82 for the development and .79 for the cross-validation sample. The subscale was chosen as it had a high Cronbach's alpha value and included items relating to metacognitive beliefs about starting, sustaining, and re-entering the flow experiences. These items were as follows:

- I am able to quickly re-enter flow if I need to. (Item 14)
- I know how I can re-create having flow if I want to. (Item 40)
- I know what I need to do to get into flow. (Item 47)
- It is in my power to control when I have flow. (Item 15)
- Once I start with the activity there is no stopping me getting into flow. (Item 51)
- I am able to sustain flow for long periods. (Item 33)

Table 4: Factor 2 – Cronbach's alpha values for five potential subscales (each containing six items) based on development (n_1=102) and cross-validation sample (n_2=102) with the chosen subscale highlighted in grey

Subscale	Analysed Items										Cronbach's Alpha	
	40	51	44	14	29	15	47	39	33	41	n_1=102	n_2=102
1	**x**	**x**	**-**	**x**	**-**	**x**	**x**	**-**	**x**	**-**	**0.82**	**0.79**
2	x	x	-	x	x	x	x	-	-	-	0.81	0.79
3	x	x	-	x	-	x	x	-	-	x	0.80	0.79
4	x	x	x	x	-	x	x	-	-	-	0.79	0.79
5	x	x	-	x	-	x	x	x	-	-	0.79	0.77

Note. 'x' denotes that the item was included in the subscale whereas '-' denotes that it was omitted.

The item reduction resulted in a final FMQ, containing 12 items, six each for factor 1 and factor 2.

4.5.3 Exploratory Factor Analysis on Final FMQ (12 Items)

The final 12-item version of the FMQ was then subjected to EFA via principal component analysis (direct oblimin rotation). The Kaiser-Meyer-Olkin value was .82, well above the recommended minimum value of .6 (Kaiser, 1970, 1974). Bartlett's Test of Sphericity was highly significant (Bartlett, 1954), with both

indicators supporting the appropriateness of the use of statistical dimension reduction. Principal component analysis confirmed that the 12 items loaded onto two main components. These explained a total of 52.4% of the variance (which had increased from 27.5% from the 53-item pilot version); 28.3% for component 1 and 24.1% for component 2. Eigenvalues for these two components exceeded 1 (Component 1 = 3.4; Component 2 = 2.9). The scree plot (Figure 3) also showed a clear break after the second component (Cattell, 1966) supporting the retention of two components. The final 12-item FMQ was then re-submitted to EFA via principal component analysis (direct oblimin rotation). The Kaiser-Meyer-Olkin value was .82 and Bartlett's Test of Sphericity was highly significant, supporting statistical dimension reduction. Principal component analysis indicated that the 12 items loaded onto two main components, which were weakly intercorrelated (r = .06). Consistent with the terminology used to label general metacognitive traits (Beer & Moneta, 2010; Wells & Cartwright-Hatton, 2004), the factors were labelled FMQ-1 Beliefs that Flow Fosters Achievement and FMQ-2 Confidence in Ability to Self-Regulate Flow. They explained a total of 52.4% of the variance, 28.3% for Component 1 and 24.1% for Component 2. See Table 5 for pattern, structure coefficients, and communalities.

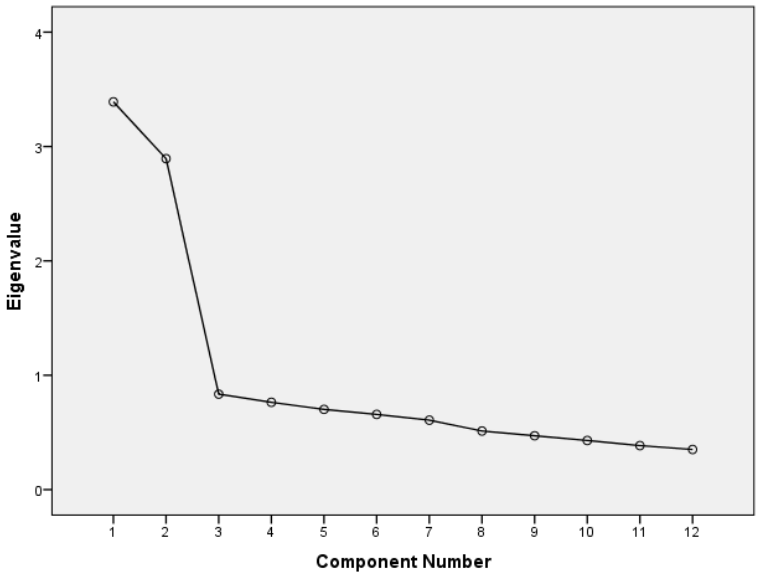


Figure 3: Scree plot of the final 12-item version of the FMQ (direct olimin rotation, N = 204)

Table 5: Descriptive statistics (means and standard deviations), pattern coefficients, structure coefficients, and communalities for the final 12-item FMQ (two-factor solution; direct oblimin rotation)

FMQ Item	X	SD	Pattern Coefficient		Structure Coefficient		Communalities
			Component 1	Component 2	Component 1	Component 2	
Flow has a positive effect on the activity.	3.37	0.73	**0.77**	-0.07	**0.76**	-0.02	0.59
I am able to generate various ideas and options while being in flow.	3.19	0.75	**0.76**	0.07	**0.77**	0.12	0.60
My thinking becomes clearer when I am in flow.	3.19	0.82	**0.75**	-0.08	**0.74**	-0.03	0.56
I become completely focused on the task when I am in flow.	3.20	0.83	**0.73**	-0.06	**0.73**	-0.01	0.53
I know that by being in flow I achieve more.	3.22	0.85	**0.72**	0.06	**0.72**	0.11	0.52
I am more creative when I am in flow.	3.19	0.82	**0.70**	0.07	**0.70**	0.11	0.50
I am able to quickly re-enter flow if I need to.	2.40	0.95	-0.05	**0.75**	-0.01	**0.75**	0.56
I know how I can re-create having flow if I want to.	2.48	0.95	0.04	**0.75**	0.09	**0.75**	0.56
I know what I need to do to get into flow.	2.39	0.86	-0.07	**0.71**	-0.03	**0.71**	0.51
It is in my power to control when I have flow.	2.5	0.93	0.06	**0.69**	0.10	**0.69**	0.48
Once I start with the activity there is no stopping me getting into flow.	2.35	0.89	-0.10	**0.68**	-0.05	**0.68**	0.47
I am able to sustain flow for long periods.	2.45	0.86	0.13	**0.62**	0.17	**0.63**	0.41

Note. N=204.

4.6 Discussion

The aim of Study 2 was to present the development of a questionnaire for the measurement of metacognitions of flow. This was achieved by designing a pilot measure and testing it on a student sample. Exploratory factor analysis established an underlying two-component solution with item reduction procedures resulting in a 12-item questionnaire with the two-subscales being corroborated. The two subscales explained 52.4% of the variance and were labelled Beliefs that Flow Fosters Achievement (FMQ-1) and Confidence in Ability to Self-Regulate Flow (FMQ-2). Findings can broadly be compared to the Positive Meta-Emotions and Metacognitions Questionnaire (PMCEQ) whose three subscales explained 54.8% of the total variance (Beer, 2011). It appears that the FMQ items capture the essence of the themes identified in the qualitative study presented in Chapter 2 effectively. In addition, the 12-item FMQ is brief and, in conjunction with the abridged FQ, it can capture both the occurrence (as measured by the FQ) and metacognitions of flow. Due to its relative succinctness the FMQ could lend itself to be included in studies on flow without necessarily contributing to participants' research fatigue. However, its usefulness as a research tool still has to be established in Studies 3 and 4 (Chapter 5 and Chapter 6).

4.6.1 Strengths and Limitations

Strengths of the study included the range of statistical analyses used, which supported the retention of two factors. However, one of the limitations was that the data quality had to be improved due to the number of missing values caused by the use of a pen-and-paper questionnaire. Therefore, a prudent approach to the imputation of values

was adopted, with statistical analyses confirming that the data imputation method was adequate. Further, the homogeneity of the student sample might limit the generalizability and therefore external validity of the results.

4.6.2 Outlook on Chapter 5

In order to build upon the findings generated by the student sample of Study 2, Study 3 (presented in Chapter 5) utilised a more diverse sample of international professionals with the aim to further establish the FMQ's construct validity by carrying out confirmatory factor analysis. In addition, the measure's concurrent and predictive validities were also tested.

Chapter 5: Further Scale Validation and Testing (Study 3)

5.1 Objective

The objective of Study 3 was twofold. The first aim was to further establish the construct validity of the 12-item FMQ by carrying out confirmatory factor analysis, with the aim to corroborate the two-factor structure established in Study 2. The second aim was to test the legitimacy of the FMQ as a research tool, and as such the importance of flow metacognitions, by assessing its predictive validity of the intensity and frequency of flow experiences in work. Study 3 would be successfully concluded if the analysis supported the two-factor structure of the FMQ and if flow metacognitions (as assessed by the FMQ) predicted flow above and beyond established measures.

5.2 Chapter Summary

Study 2 (in Chapter 4) had successfully tested the 12-item FMQ with exploratory factor analysis suggesting an underlying two-factor structure. The aim of Study 3 was to further establish the FMQ's construct validity and also to provide initial evidence for its predictive validity. A convenience sample of 159 international workers was recruited. Participants completed a range of measures capturing both maladaptive (MCQ-30) and adaptive metacognitions (PMCEQ). In addition, the general experience and frequency of flow was assessed with the FQ. The intensity of flow in work was based on the SDFS-2, the FSS, and the SFWS. Confirmatory factor analysis supported the two subscales of the final 12-item FMQ. Further, the FMQ's predictive validity was established in a series of hierarchical regression analyses. Confidence in Ability to Self-Regulate Flow (FMQ-2)

outperformed measures of maladaptive and adaptive metacognitions in predicting the intensity of flow in work. It also predicted the frequency and percentage of time spent in flow in work above and beyond established measures of flow, highlighting the usefulness of the FMQ as a research tool and the importance of flow metacognitions.

5.3 Introduction

Metacognitions were described as guiding cognition and behaviour and, therefore, were not pure 'epiphenomena' (Koriat, 2002). The link between metacognitions and cognition was confirmed experimentally, by establishing a causal link between maladaptive metacognitions and psychological dysfunction (e.g. Fisher & Wells, 2005). Furthermore, despite metacognitions' trait-like conceptualisation, metacognitive therapy was found to be successful in modifying people's maladaptive beliefs in their cognitions in a range of disorders, including different forms of anxiety disorders, obsessive compulsive disorder, and depression (Wells, 2000, 2011), lending support to underlying causal mechanisms which could be altered. Research by Beer and Moneta (2012a) also found that adaptive metacognitive beliefs were associated with fostering adaptive coping as well as preventing maladaptive coping and reducing perceived stress during demanding encounters. Furthermore, a link between adaptive metacognitions and flow has been suggested. As noted by Beer (2011) adaptive metacognitions and flow have in common that they could both be activated in demanding situations. Although a link between the two constructs had been hypothesised, and was called for to be investigated (Beer, 2011), it had not been formally measured. Further, as flow is predominantly a cognitive phenomenon, it was hypothesised that people who tackle demanding tasks, particularly in work

environments, would not only activate general adaptive metacognitions, but also activate metacognitions specific to the flow state, which in turn would facilitate the experience of flow. As such, flow-specific metacognitions should predict the intensity and frequency of flow over and above general adaptive metacognitions. Furthermore, the FMQ's association with already established measures of flow and metacognition, i.e. its concurrent validity, needed to be fully understood. If flow metacognitions meaningfully captured people's beliefs about flow, it would be expected that flow metacognitions would correlate to some extent (i.e. moderately and positively) with measures of the intensity of flow. Further, if one considered the FMQ subscales being part of a potentially wider array of adaptive metacognitions, one would expect that these would also correlate positively with general adaptive metacognitive traits. Overall, this part of the study aimed to establish the measure's concurrent validity, particularly in the context of flow at work, as this domain was found to provide the best conditions for experiencing flow as well as the potential for intervention.

Two main hypotheses were explored in relation the FMQ's predictive validity and its usefulness as a research tool. First, the ability of flow metacognitions (as measured by the FMQ) to predict the intensity of flow above and beyond maladaptive and adaptive metacognitions was measured (*hypothesis 1*).

Second, it was tested whether flow metacognitions (as measured by the FMQ) predicted the frequency of flow experiences. It was hypothesised that flow metacognitions would outperform established measures of flow and adaptive metacognition in predicting the frequency of flow (*hypothesis 2*).

5.4 Method

5.4.1 Participants

A new convenience sample of 317 international professionals was recruited via social and professional networks, and participants completed an online questionnaire posted on Survey Monkey. The study received University Ethics approval, and all participants provided informed consent. As the focus was on flow at work, participants who did not experience flow (n = 52, 16.4%) and those who stated a leisure activity as their chosen flow activity (n = 106, 33.4%), as measured by the FQ, were excluded from the analysis. The resulting sample comprised 159 work flow-ers (50.2% of total sample); 56.0% were females. As the sample comprised only workers, the mean age at 37.3 years (*SD* = 10.9, *range* = 21 – 69) was higher than that of the student sample in Study 2.

5.4.2 Measures

Metacognitions. Maladaptive metacognitions were measured via the 30-item *Meta-Cognitions Questionnaire* (MCQ-30, Wells & Cartwright-Hatton, 2004) along five factors (Cognitive Confidence; Positive Beliefs about Worry; Cognitive Self-Consciousness; Negative Beliefs about Worry Concerning Uncontrollability and Danger; and Beliefs about the Need to Control Thoughts). The *Positive Metacognitions and Meta-Emotions Questionnaire* (PMCEQ; Beer & Moneta, 2010) measured three adaptive metacognitions: Confidence in Extinguishing Perseverative Thoughts and Emotions (PMCEQ-1); Confidence in Interpreting Own Emotions as Cues, Restraining from Immediate Reaction, and Mind Setting for Problem Solving (PMCEQ-2), and

Confidence in Setting Flexible and Feasible Hierarchies of Goals (PMCEQ-3). The *Flow Metacognitions Questionnaire (FMQ)* is the 12-item scale developed in Study 2, albeit with a slightly adapted preamble to prompt people to predominantly report flow experiences in work. See Appendix 5.

Flow. As opinions have diverged over the operationalisation and measurement of flow (for a review see Moneta, 2012b), three flow scales were used to assess the intensity of flow during work: the *Short Dispositional Flow Scale-2* (SDFS-2; Jackson, et al., 2008), the *Flow Short Scale* (FSS; Rheinberg et al., 2003), the *Short Flow in Work Scale* (SFWS; Moneta, 2012a). As such this study measured flow as a disposition specific to the domain of work, as participants reported the intensity of their flow experiences during work in general. The frequency of flow was measured via the Flow Questionnaire (FQ) as used in Study 2. Participants who experienced flow were asked to select one activity which was most representative of the flow experience and to report how often they experienced flow during this activity in the past twelve months (score range: 1 = a few times a year; 2 = once a month; 3 = a few times a month; 4 = once a week; 5 = a few times a week; 6 = every day), measuring the frequency of flow, and for what percentage of time they experienced flow (scores ranged from 1 = 1–10% to 10 = 91–100%).

5.5 Results

5.5.1 Construct Validity

CFA was carried out on the FMQ using LISREL 8.80 (Jöreskog & Sörbom, 1996, 2006). The two factors were defined as latent variables. Internal consistencies of

all measures (Table 6) were satisfactory to good (Nunnally & Bernstein, 1994). The chi-square test was significant ($\chi^2 = 86.50$, $df = 53$, $p < 0.01$), indicating that the model did not fit strictly. However, other goodness of fit statistics indicated adequate fit (*CFI* = 0.97, *RMSEA* = 0.063, *90% CFI for RMSEA*: 0.04–0.09, *NFI* = 0.93) based on the standards set out by Hu and Bentler (1999), therefore supporting a two-factor model.

The model-based estimate of the correlation between the factors was .40 (Figure 4). This was stronger than found for the EFA in Study 2. Possible explanations for this difference could be that the reduction of the number of items increased their similarities, and only work flow-ers were included in the current sample.

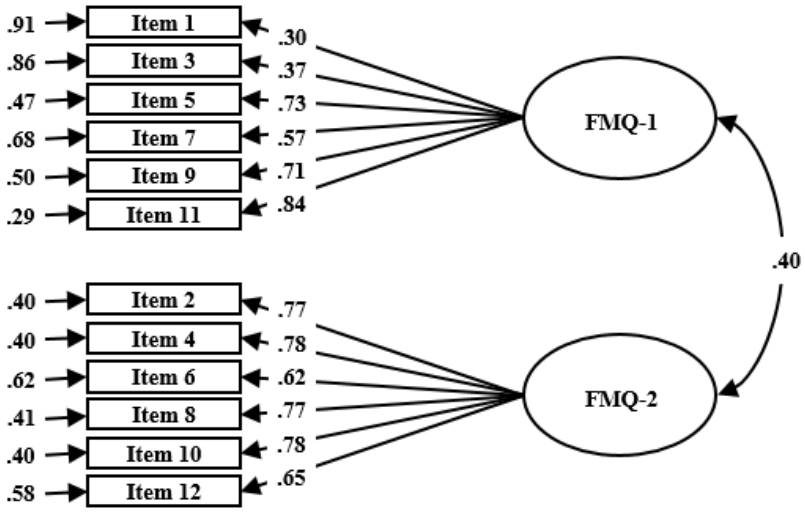


Figure 4: Standardised factor loadings and measurement errors from CFA

Notes. N=159. Factor Labels: FMQ-1 Beliefs that Flow Fosters Achievement; FMQ-2 Confidence in Ability to Self-Regulate Flow.

5.5.2 Concurrent Validity

Bivariate correlations between FMQ-1 and FMQ-2 were medium (r = .36) suggesting that both factors were related but relatively distinct. As expected, both FMQ-1 and FMQ-2 correlated positively with the three flow measures (SDFS-2, FSS, and SFWS), indicating that people with higher flow metacognitions experienced flow more intensely (Table 6). These correlations were weak for FMQ-1 but medium to high for FMQ-2, also implying that measures of flow and flow metacognitions were related but distinct. FMQ-1 correlated positively and significantly with two adaptive metacognitive traits (PMCEQ-2 and PMCEQ-3), but these correlations were weak. It was not correlated with PMCEQ-1 (Confidence in Extinguishing Perseverative Thoughts and Emotions). FMQ-2 correlated positively and significantly with all three adaptive metacognitions, with correlations ranging from low to medium. Therefore, the hypothesised positive associations between adaptive and flow metacognitions were largely confirmed. Flow metacognitions and maladaptive metacognitions were only weakly correlated. Correlations were all negative for FMQ-2, it correlated significantly only with two MCQ-30 subscales (Negative Beliefs about Worry Concerning Uncontrollability and Danger; Cognitive Confidence). Measures of flow also correlated only very weakly and negatively with the MCQ-subscales. In the case of the SFWS there were no correlations with maladaptive metacognitions indicating that the three components included in the SFWS, i.e. loss of self-consciousness, centring of attention, and merging of action and awareness were not related to maladaptive metacognitions. In summary, the FMQ subscales were found to have good concurrent validity by correlating meaningfully with validated measures of flow and adaptive metacognitions.

Table 6: Means, standard deviations, Cronbach's alpha values, and one-tailed Pearson's product–moment correlations of study variables

Variables	*X*	*SD*	Alpha	2	3	4	5	6	7	8	9	10	11	12	13
Flow metacognitions															
1. FMQ-1	3.54	0.49	0.77	.36**	-.04	.27**	.25**	.18*	.01	.05	.08	.10	.28**	.24**	.22**
2. FMQ-2	2.39	0.74	0.87		.22**	.35**	.37**	-.13	-.19*	-.21**	-.06	-.05	.44**	.53**	.44**
Adaptive metacognitions															
3. PMCEQ-1	2.91	0.67	0.82			.38**	.31**	-.40**	-.71**	-.32**	-.45**	-.37**	.10	.27**	-.03
4. PMCEQ-2	2.51	0.58	0.74				.71**	-.01	-.37**	-.11	-.04	-.08	.44**	.37**	.25**
5. PMCEQ-3	2.96	0.59	0.85					-.05	-.28**	-.21**	-.11	.02	.44**	.44**	.31**
Maladaptive metacognitions															
6. MCQ-30-1	1.75	0.63	0.87						.37**	.25**	.40**	.37**	-.10	-.09	.05
7. MCQ-30-2	1.93	0.79	0.88							.37**	.56**	.36**	-.17*	-.24**	.06
8. MCQ-30-3	1.67	0.61	0.84								.30**	.18*	-.19*	-.20*	.08
9. MCQ-30-4	1.71	0.56	0.71									.36**	-.06	-.12	.06
10. MCQ-30-5	2.44	0.69	0.84										-.19*	-.14	.05
Flow measures															
11. SDFS-2	3.60	0.42	0.71											.59**	.43**
12. FSS	3.71	0.85	0.86												.38**
13. SFWS	2.98	0.64	0.71												-

Notes. N=159. Measure Labels: FMQ-1 Beliefs that Flow Fosters Achievement; FMQ-2 Confidence in Ability to Self-Regulate Flow; PMCEQ-1 Confidence in Extinguishing Perseverative Thoughts and Emotions; PMCEQ-2 Confidence in Interpreting Own Emotions as Cues, Restraining from Immediate Reaction, and Mind Setting for Problem Solving; PMCEQ-3 Confidence in Setting Flexible and Feasible Hierarchies of Goals; MCQ-30-1 Positive Beliefs about Worry; MCQ-30-2 Negative Beliefs about Worry Concerning Uncontrollability and Danger; MCQ-30-3 Cognitive Confidence; MCQ-30-4 Beliefs about the Need to Control Thoughts; MCQ-30-5 Cognitive Self-Consciousness; SDFS-2 Short Dispositional Flow Scale-2; FSS Flow Short Scale; SFWS Short Flow in Work Scale. *p<0.05; **p<0.01.

5.5.3 Predictive Validity

The predictive validity of flow metacognitions (as measured by the FMQ) was established by assessing their prediction of the intensity of flow (hypothesis 1) as well as the frequency of flow (hypothesis 2).

Predicting the intensity of flow (hypothesis 1): Three hierarchical regression analyses were run, entering maladaptive metacognitions in step 1, adaptive metacognitions in step 2, and flow metacognitions in step 3, with the three flow scales (SDFS-2; FSS, SFWS) being the outcomes (Table 7). The variance explained in the intensity of flow by the final models ranged from 28 to 38%. In step 3, FMQ-2 was the strongest predictor of flow intensity as measured by the FSS ($F(10,148) = 8.92$, $p < .001$) and SFWS ($F(10,148) = 5.67$, $p < .001$), with PMCEQ-3 being the other main predictor. For SDFS-2 ($F(10,148) = 9.14$, $p < .001$) as the outcome measure, FMQ-2 was the second strongest predictor in step 3, after PMCEQ-1. Hypothesis 1 was therefore partly supported.

Table 7: Summary of three hierarchical regression analyses predicting flow intensity measured by three flow scales with maladaptive, adaptive, and flow metacognitions as predictors (continued on next page)

	Short Dispositional Flow Scale-2 (SDFS-2)				Flow Short Scale (FSS)				Short Flow in Work Scale (SFWS)			
Model	B	SE(B)	β	ΔR^2	B	SE(B)	β	ΔR^2	B	SE(B)	β	ΔR^2
Step 1				0.07*				0.08*				0.01
MCQ-30-1	-0.00	0.06	-0.01		0.02	0.12	0.02		0.02	0.09	0.02	
MCQ-30-2	-0.06	0.05	-0.11		-0.21	0.11	-0.19		0.01	0.08	0.01	
MCQ-30-3	-0.10	0.06	-0.15		-0.19	0.12	-0.14		0.06	0.09	0.06	
MCQ-30-4	0.08	0.07	0.11		0.07	0.15	0.05		0.02	0.12	0.02	
MCQ-30-5	-0.09	0.05	-0.16		-0.08	0.11	-0.07		0.02	0.08	0.02	
Step 2				0.23***				0.16***				0.13***
MCQ-30-1	-0.05	0.05	-0.08		0.01	0.11	0.01		-0.01	0.09	-0.01	
MCQ-30-2	-0.01	0.06	-0.02		0.01	0.12	0.01		0.10	0.10	0.13	
MCQ-30-3	-0.09	0.05	-0.13		-0.12	0.11	-0.08		0.10	0.09	0.10	
MCQ-30-4	0.02	0.07	0.02		0.03	0.14	0.02		-0.02	0.11	-0.02	
MCQ-30-5	-0.13	0.05	-0.21**		-0.13	0.10	-0.11		-0.02	0.08	-0.02	
PMCEQ- 1	-0.16	0.06	-0.26*		0.11	0.14	0.09		-0.06	0.11	-0.06	
PMCEQ- 2	0.22	0.08	0.31**		0.09	0.16	0.06		0.12	0.13	0.11	
PMCEQ- 3	0.19	0.07	0.27**		0.52	0.15	0.36***		0.33	0.12	0.30**	

Model	Short Dispositional Flow Scale-2 (SDFS-2)				Flow Short Scale (FSS)				Short Flow in Work Scale (SFWS)			
	B	SE(B)	β	ΔR^2	B	SE(B)	β	ΔR^2	B	SE(B)	β	ΔR^2
Step 3				0.08***				0.14***				0.14***
MCQ-30-1	-0.05	0.05	-0.07		0.06	0.11	0.04		0.03	0.09	0.03	
MCQ-30-2	-0.02	0.05	-0.03		-0.00	0.11	-0.00		0.10	0.09	0.12	
MCQ-30-3	-0.07	0.05	-0.10		-0.04	0.10	-0.03		0.17	0.08	0.16*	
MCQ-30-4	0.01	0.06	0.01		-0.00	0.13	-0.00		-0.05	0.10	-0.04	
MCQ-30-5	-0.13	0.04	-0.22**		-0.14	0.09	-0.11		-0.02	0.07	-0.02	
PMCEQ- 1	-0.16	0.06	-0.26**		0.09	0.13	0.07		-0.08	0.10	-0.08	
PMCEQ- 2	0.17	0.07	0.24*		-0.04	0.15	-0.02		0.03	0.12	0.03	
PMCEQ- 3	0.14	0.07	0.21*		0.40	0.14	0.28**		0.24	0.11	0.22*	
FMQ-1	0.09	0.06	0.10		0.06	0.13	0.04		-0.02	0.11	-0.01	
FMQ-2	0.14	0.04	0.25**		0.47	0.09	0.40***		0.37	0.07	0.42***	

Notes. N = 159. Measure labels: See Table 6.
*p < 0.05; **p < 0.01; ***p < 0.001.

Predicting the frequency of flow (hypothesis 2): Table 8 presents two hierarchical regression models with frequency of flow (and percentage time in flow) as outcome measure, with the three measures of flow intensity entered in step 1, adaptive metacognitions in step 2, and FMQ subscales in step 3. The final model explained 32% of the variance in the frequency of flow ($F(8,150) = 8.95$, $p < .001$) and 34% of the variance of the percentage time spent in flow ($F(8,150) = 9.53$, $p < .001$). As FMQ-2 was the strongest predictor in both models, hypothesis 2 was partly supported.

Table 8: Summary of hierarchical regression analyses with frequency of flow (and percentage time in flow) as outcome measure predicted by three flow scales, adaptive metacognitions, and flow metacognitions

	Frequency of flow				Percentage of time in flow			
Model	B	SE(B)	β	ΔR^2	B	SE(B)	β	ΔR^2
Step 1				0.24***				0.24***
SDFS-2	0.43	0.34	0.11		0.71	0.54	0.12	
FSS	0.43	0.16	0.24**		0.52	0.25	0.18*	
SFWS	0.63	0.19	0.26**		1.14	0.30	0.30***	
Step 2				0.02				0.02
SDFS-2	0.45	0.36	0.12		0.83	0.56	0.14	
FSS	0.34	0.17	0.18*		0.37	0.27	0.13	
SFWS	0.61	0.19	0.25**		1.20	0.31	0.32***	
PMCEQ - 1	0.13	0.18	0.05		0.49	0.29	0.13	
PMCEQ - 2	-0.42	0.28	-0.16		-0.39	0.45	-0.09	
PMCEQ - 3	0.55	0.27	0.21*		0.28	0.43	0.07	
Step 3				0.06**				0.08***
SDFS-2	0.33	0.35	0.09		0.66	0.54	0.11	
FSS	0.17	0.17	0.09		0.04	0.27	0.01	
SFWS	0.45	0.19	0.18*		0.85	0.30	0.22**	
PMCEQ - 1	0.12	0.18	0.05		0.36	0.28	0.10	
PMCEQ - 2	-0.55	0.28	-0.20*		-0.52	0.43	-0.12	
PMCEQ - 3	0.52	0.26	0.20*		0.26	0.41	0.06	
FMQ-1	0.39	0.24	0.12		-0.04	0.37	-0.01	
FMQ-2	0.52	0.19	0.24**		1.23	0.29	0.37***	

Notes. N = 159. Measure labels: See Table 6.
*p < 0.05; **p < 0.01; ***p < 0.001.

5.6 Discussion

The aims of Study 3 were to validate the final 12-item FMQ (developed in Study 2). Confirmatory factor analysis on a worker sample corroborated the two subscales, i.e. Beliefs that Flow Fosters Achievement (FMQ-1) and Confidence in Ability to Self-Regulate Flow (FMQ-2). These correlated meaningfully with established measures of flow and adaptive metacognition, supporting the FMQ's construct and concurrent validity. In addition, flow metacognitions (as measured by the FMQ-2) predicted the intensity of flow above and beyond maladaptive and adaptive metacognitions, and the frequency of flow and percentage time in flow in work above and beyond established measures of flow intensity and adaptive metacognitions, supporting FMQ-2's predictive validity as well as the importance of this metacognitive factor. These findings are supported by Beer and Moneta's (2010) assumption of psychological adaptation being fostered by adaptive metacognitions. Although FMQ-1 correlated meaningfully with flow it was not a predictor of the frequency or intensity of flow. Taking these two finding together, an important implication follows: Changing people's beliefs about the usefulness of being in flow may not necessarily result in increased flow experiences. However, interventions focused at people's confidence in the self-regulation of flow would be expected to reap rewards. This implication may at first appear counterintuitive. However, an analogy may aid in explaining this further. People may hold a general belief that eating fruit and vegetables is beneficial to a balanced diet. One can assume that the majority would agree with the notion that '5 A DAY' are 'good for you'.[9] However, just having a general belief about the positive attributes of, in this case fruit

[9] The UK National Health Service (NHS) has been promoting the consumption of at least five portions of fruit and vegetables per day with the '5 A DAY' initiative.

and vegetables, is not sufficient for actually adopting a healthy lifestyle. People need the tools, such as the knowledge of how to prepare the food correctly, or how to purchase healthy food on a budget (as advocated by the '5 A DAY' initiative). Flow metacognitions appear to behave in a similar fashion. Simply having a general belief that flow is 'good for you' is not sufficient in creating this optimal experience or making it more frequent or intense. One also needs to have an understanding and mastery of the tools (i.e. the self-regulation of flow) to make flow happen.

5.6.1 Strengths and Limitations

The main strength of the study was that it provided initial evidence of the usefulness of flow metacognitions in the context of work. However, the main limitation was that this study was only correlational in nature and, therefore, causation could not be established.

5.6.2 Outlook on Chapter 6

The results of Study 3 indicated that people who tackled demanding tasks in work contexts, might not only activate general adaptive metacognitions, but also activate metacognitions specific to the flow state, which in turn appeared to facilitate and intensify the experience of flow. However, the direction of this relationship could only be hypothesised at this stage. Longitudinal analysis was, therefore, conducted in Study 4 and described in the next chapter (Chapter 6) to shed light on a potential causal relationship between flow metacognitions and flow experiences at work.

Chapter 6: Metacognitions and Flow – Evidence of a Causal Relationship (Study 4)

6.1 Objective

This objective of this study was to further establish that the construct of flow metacognitions, as measured by the FMQ, was scientific meaningful. In particular, the aim was to test the hypothesis that flow metacognitions would influence flow. If this was indeed the case, one would expect to find longitudinal effects, indicating a causal link between flow metacognitions and flow experiences. Study 4 would be successfully concluded if a longitudinal study provided initial evidence for a causal relationship between flow metacognitions and flow.

6.2 Chapter Summary

Study 3 in Chapter 5 concluded that people's confidence in their ability to self-regulate flow experiences predicted the intensity and frequency of flow in work above and beyond established measures of flow and measures of adaptive and maladaptive metacognitions. However, Study 3 was correlational in nature. Study 4 built upon Study 3 by hypothesising a causal relationship between flow metacognitions and flow at work. A sample of 101 professionals took part in a two-wave longitudinal study by completing the FMQ and the same measures of flow used in Study 3, i.e. the SDFS-2, the FSS, and the SFWS (Moneta, 2012a). A series of structural equation models partly confirmed the study hypothesis, suggesting a causal relationship between FMQ-2 at time 1 predicting flow at work at time 2. A reversed causal relationship, however, with flow at time 1

predicting flow metacognitions at time 2, was not found. The results suggest that flow metacognition (FMQ-2) could be conceptualised as an antecedent of flow.

6.3 Introduction

The previous chapters detailed how the FMQ was developed, validated, and tested in Studies 1 to 3. The FMQ was found to have good construct and concurrent validity, correlating meaningfully with established measures of flow and adaptive metacognitions. Furthermore, the FMQs legitimacy as a research instrument was supported by showing that people's confidence in the ability to self-regulate flow (FMQ-2) predicted the intensity and frequency of flow in work. One question which had yet to be answered was whether flow metacognitions have any potential causal effect on flow. It was also important to ascertain the temporal stability of flow metacognitions. In particular, it was necessary to analyse whether their behaviour was more state-like, predominantly influenced by the situation, as was argued to be the case with flow in work (Fullagar & Kelloway, 2009), or whether they were relatively stable, trait-like personality characteristics, more similar to the characteristics of maladaptive and adaptive metacognitions. In order to answer these questions a longitudinal study design was necessary. To date, no longitudinal study has assessed flow metacognitions in work contexts. If there was a controllable part to flow experiences (i.e. an antecedent in eliciting flow), it would be important to understand if the self-regulation of flow, as measured by FMQ-2, also predicted flow longitudinally. Building upon this assumption, this study aimed to assess the relationship between Confidence in Ability to Self-Regulate Flow (FMQ-2) and the intensity of work-related flow. Two-wave longitudinal data were collected. In line with general metacognitions as predictors of (maladaptive

and adaptive) behaviour, it was postulated that flow metacognition (FMQ-2) would have a causal effect on flow at work. Therefore, the following causal hypothesis was posited:

> *Hypothesis:* Flow metacognition (FMQ-2) at time 1 will predict flow at work at time 2. (Causal hypothesis)

The hypothesis was tested independently for FMQ-2, yet, the analysis was also repeated for FMQ-1 for explanatory purposes. Furthermore, the reverse and reciprocal relationships were considered during the evaluation of the hypothesis. In addition, this study aimed to ascertain the stability of flow metacognitions over time.

6.4 Method

6.4.1 Participants and Procedure

A longitudinal, two-wave study design was adopted, with participants completing a range of self-report measures on flow and flow metacognitions. A convenience sample was recruited via social and professional networks. Participants were asked to volunteer in a two-part study on optimal experiences in work and leisure. The study received University Ethics approval, and all participants provided informed consent to take part in both phases of the study. They completed an online questionnaire (via a link to the Survey Monkey website) at two points in time, approximately three months apart. Times 1 and 2 responses were matched via a unique password (provided by the researcher), which the participants could also self-generate in order to ensure full anonymity. Participants took approximately 30 minutes to complete the questionnaire at both times.

The questionnaire was completed at time 1 by 172 international workers, with ages ranging from 21 to 69 years (M = 38.5, SD = 10.4 years). Just over half (55.2%) were female. The sample was predominantly White (83.7) and highly educated, with 88.4% having earned an undergraduate degree and 55.8% a postgraduate degree. As highlighted in Study 2, having a highly educated sample may affect the generalisability of the study's findings. For example, it could be that highly educated people are more eloquent in verbalizing their metacognitive beliefs related to flow experiences, whereas less educated people may – despite being able to make flow happen when required – be less able to report about their metacognitive beliefs. The questionnaire was completed at time 2 by 141 participants, of which 125 could successfully be matched to the questionnaire at time 1, resulting in a 73% follow-up rate (after approximately three months).[10] There were no statistically significant differences between the sample dropouts (i.e. those who only completed the questionnaire at time 1 but not time 1, n = 47) and those participants who completed both phases of the study (n = 125) in terms of age, flow intensity (as measured by the SDFS-2, FSS, and SFWS), flow metacognitions (FMQ-1, FMQ-2), and gender.[11]

[10] Sixteen participants could not be matched as they had either not completed the questionnaire at time 1 (n = 4) or had used incorrect identifiers (n = 12); in addition, 47 completed the first survey but not the second.

[11] T-test for independence was calculated to test for significant differences between the two groups for, age: $M_{T1\&T2}$ = 39.1, $SD_{T1\&T2}$ = 10.8, $M_{dropouts}$ = 37.0, $SD_{dropouts}$ = 9.4; $t(170) = 1.2$, $p = .23$ (two-tailed); flow intensity (SDFS-2): $M_{T1\&T2}$ = 3.4, $SD_{T1\&T2}$ = .48, $M_{dropouts}$ = 3.6 , $SD_{dropouts}$ = .4; $t(170) = -1.7$, $p = .10$ (two-tailed); flow intensity (FSS): $M_{T1\&T2}$ = 3.4, $SD_{T1\&T2}$ = .9, $M_{dropouts}$ = 3.5, $SD_{dropouts}$ = 1.0; $t(170) = -.50$, $p = .63$ (two-tailed); and flow intensity (SFWS): $M_{T1\&T2}$ = 2.6, $SD_{T1\&T2}$ = .7, $M_{dropouts}$ = 2.7, $SD_{dropouts}$ = .8; $t(170) = -1.0$, $p = .32$ (two-tailed); FMQ-1: $M_{T1\&T2}$ = 3.4, $SD_{T1\&T2}$ = .50, $M_{dropouts}$ = 3.6, $SD_{dropouts}$ = .51; $t(144) = -1.4$, $p = .18$ (two-tailed); and FMQ-2: $M_{T1\&T2}$ = 2.3, $SD_{T1\&T2}$ = .7, $M_{dropouts}$ = 2.4, $SD_{dropouts}$ = .80; $t(144) = -.50$, $p = .62$ (two-tailed). Chi-square tests for independence (with Yates Continuity Correction for 2 x 2 tables) were calculated for the two groups (T1 & T2 sample vs dropouts) by sex (male vs. female): $\chi^2(1, n = 172) = 2.35$ $p = .13$.

Of those 125 who had complete time 1 and time 2 data, nine participants reported that they had never experienced flow at either point in time. Interestingly, five participants reported that they had experienced flow in their life at time 1 but not at time 2, and ten not at time 1 but at time 2. A number of reasons could explain these findings. For example, some people experience flow very rarely. Therefore, memory recall for flow experiences at time 2 could have been an issue, as participants might no longer remember one of the few flow experiences they had reported at time 1. However, the data did not seem to support this assumption. Although participants who reported flow at time 1 but not at time 2 (n = 5) did experience flow less frequently (M = 3.2, SD = 1.3) compared to those who experienced flow at both points in time (n = 101, M = 3.8, SD = 1.4), the difference was not statistically significant. Participants might have also lacked motivation to complete the questionnaire the second time around, and may have reported no flow experiences in order to complete the questionnaire more quickly. However, given that the proportion of people experiencing flow at time 2 had actually increased, this explanation seemed unlikely. Having completed the FQ the first time, potential flow experiences which had not been recalled at the time may have become more accessible at time 2, and participants were therefore able to recall instances of flow experiences more easily, which could account for the increased number of people experiencing flow at time 2.

In total, 101 participants (80.8% of matched cases) reported that they had experienced flow in either work or leisure at both times 1 and 2, and hence were retained for the analysis in their capacity as flow-ers. Their gender distribution was 42.6% male and 57.4% female. The large majority was White (85.1%), the sample was

highly educated (91.1% with undergraduate and 57.6% with postgraduate degrees), and ages ranged from 21–69 years (M = 39.2, SD = 11.0 years). The average questionnaire follow-up time was 91.6 days (SD = 15.5 days) and ranged from 54.8 to 132.3 days. Table 9 shows the distribution of background variables in the study sample and the samples of origin.

Table 9: Characteristics of study sample, which included all participants who completed both the time 1 and time 2 questionnaires and were classified as flow-ers, and samples of origin

Characteristics		Sample (T1)	Sample (T2)	Sample (T1 and T2)	Study Sample
Sample	N	172	141	125	101
	Mean age	38.5	39.7	39.1	39.2
	SD age	10.4	10.9	10.8	11.0
Gender	Male	77 (44.8%)	59 (41.8%)	51 (40.8%)	43(42.6%)
	Female	95 (55.2%)	82 (58.2%)	74 (59.2%)	58 (57.4%)
Education	Undergraduate	152 (88.4%)	115 (81.6%)	111 (88.8%)	92 (91.1%)
	Postgraduate	96 (55.8%)	74 (52.5%)	72 (57.6%)	72 (57.6%)
	Missing[a]	--	12 (8.5%)	--	--
Ethnicity	White	144 (83.7%)	110 (78.0%)	106 (84.8%)	86 (85.1%)
	Non white	28 (16.3%)	19 (13.5%)	19 (15.2%)	15 (14.9%)
	Missing[a]	--	12 (8.5%)	--	--
Employment	Full-time	146 (84.8%)	109 (77.3%)	107 (84.8%)	87 (86.1%)
	Part-time	22 (12.8%)	18 (12.8%)	17 (13.6%)	13 (12.9%)
	Other	4 (2.3%)	1 (0.7%)	1 (0.8%)	1 (1.0%)
	Missing [a]	--	13 (9.2%)	--	--
Flow type	Experienced flow	146 (84.9%)	124 (87.9%)	T1: 106 (84.8%)	T1: 101 (100.0%)
				T2: 111 (88.8%)	T2: 101 (100.0%)
	No flow	26 (15.1%)	17 (12.1%)	T1: 19 (15.2%)	T1: 0 (0.0%)
				T2: 14 (11.2%)	T2: 0 (0.0%)

Note. [a] Twelve participants could not be matched due to incorrect identifiers, and employment information was not recorded for one additional participant.

6.4.2 Measures

Measures of flow and flow metacognitions: The occurrence of flow (i.e. whether a participant has ever experienced flow) was measured with the FQ as used in Study 3. Moreover, given the ongoing debate on the measurement of flow (e.g. Fullagar, Knight, & Sovern, 2013), and to aid comparability across Studies 3 and 4, the same three measures of the intensity of flow as in Study 3 were used, i.e. the SDFS-2, the FSS, and the SFWS. Participants were asked to reflect on the items of these measures in the context of their work. Flow metacognitions were measured using the 12-item FMQ.

6.4.3 Statistical Analysis

Four competing models were tested with LISREL 8.8 (Jöreskog & Sörbom, 1996, 2006). In all models, flow metacognitions (FMQ-1 and FMQ-2) at times 1 and 2 and intensity of flow at work at times 1 and 2 (measured via the three flow scales, i.e. the SDFS-2, FSS, and SFWS) were defined as latent variables, and their respective constituent items were defined as congeneric indicators of the latent variables. In all models, the measurement model allowed the individual item errors to correlate across the time 1 and time 2 administrations (e.g. the measurement error of one item measuring FMQ-1 at time 1 was allowed to covary with the measurement error of the same item at time 2) in order to account for the method variance of each item (Pitts, West, & Tein, 1996), and hence obtain the best possible measurement model as a platform to test and compare the structural relationships of the hypothesised and alternative models. The four competing structural equation models were run separately for the two flow metacognitive factors and the three flow scales (i.e. running a total of 24 models).

The four structural equation models tested the following: Model 1, the stability model, assessed the test–retest reliability between flow metacognition at times 1 and 2 and flow at times 1 and 2. It specified temporal stabilities between time 1 flow metacognition and time 2 flow metacognition and between time 1 flow and time 2 flow as well as cross-sectional correlations between metacognition and flow, but it did not include cross-lagged paths indicating delayed effects between the study variables. Model 2, the causality model, was built upon the stability model and hypothesises a causal relationship – as specified in the hypothesis – via a structural cross-lagged path between flow metacognition at time 1 and flow at time 2, controlling for temporal stability and cross-sectional correlations. Further, Model 3 tested a reversed causality model, which was built upon the stability model, and introduced a structural cross-lagged path between flow at time 1 and flow metacognition at time 2, controlling for temporal stability and cross-sectional correlations. Finally, the reciprocal model, Model 4, was a combination of Models 2 and 3, introducing both cross-lagged paths included in the causality and reversed causality models, controlling for temporal stability and cross-sectional correlations. See Figure 5 for a graphical representation of the structural paths of Model 2.

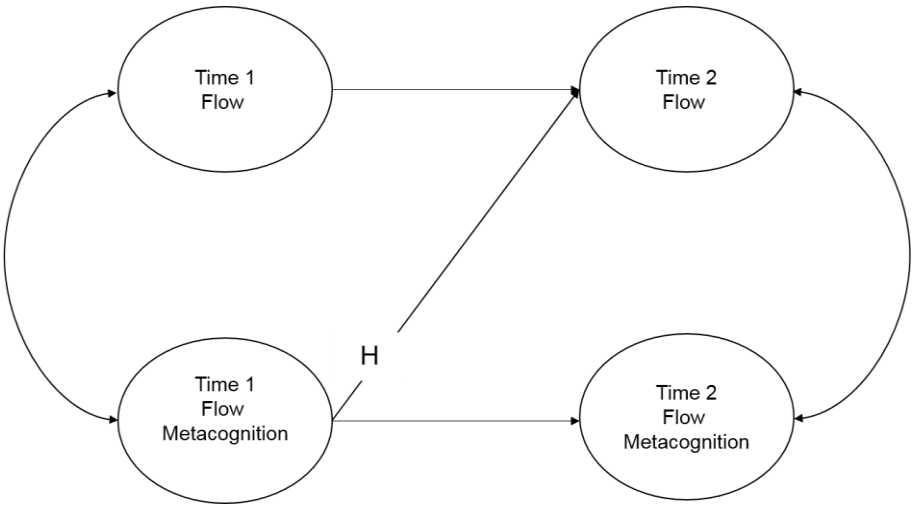


Figure 5: Graphical representation of structural paths (Model 2)

Model fit was assessed via the cut-off values for acceptable fit proposed by Hu and Bentler (1999). These were as follows: Cut-off points of .95 and larger for the Comparative Fit Index (CFI) and the Non-Normed Fit Index (NNFI); cut-off points of .08 and lower for the Root Mean Square Error of Approximation (RMSEA). Models 2 (causal model), 3 (reversed causal model), and 4 (reciprocal model) were compared to the stability model (Model 1) based on their difference in chi-square values (chi-square difference test; Jöreskog & Sörbom, 1996).

6.5 Results

6.5.1 Data Description

Descriptive statistics of the study variables can be found in Table 10. Internal consistencies of the measures were satisfactory to good, with all Cronbach's alpha coefficients exceeding .70 (Nunnally & Bernstein, 1994). FMQ-1 correlated positively and significantly with all flow measures at T1 but correlations were small (T1 correlations with flow measures ranged from r = .25 to r = .29; T2 correlations ranged

from r = .18 to r = .28). Correlations between FMQ-1 and FMQ-2 were moderate at times 1 and times 2 (r_{T1} = .36, r_{T2} = .40), indicating that both scales captured related but distinct constructs. FMQ-2 correlated positively and significantly with the three flow measures, with correlations being medium to large for T1 (r = .41 to r = .61) and T2 (r = .55 to r = .57). Test–retest reliabilities were obtained by fitting a stability model for each variable separately. These were as follows; for flow metacognitions FMQ-1, r = .57; FMQ-2, r = .81; and for flow SDFS-2, r = .68; FSS, r = .74; SFWS, r = .67.

Table 10: Means, standard deviations, Cronbach's alpha values, and one-tailed Pearson's product–moment correlations of study variables at times 1 and 2

Variables	X	SD	Alpha	Time 1				Time 2				
				2.	3.	4.	5.	6.	7.	8.	9.	10.
Time 1												
1. FMQ-1	3.46	.48	.77	.36**	.26**	.25*	.29**	.54**	.35**	.24*	.18	.22*
2. FMQ-2	2.31	.69	.85		.49**	.61**	.41**	.28**	.76**	.46**	.55**	.52**
3. SDFS-2	3.49	.46	.76			.67**	.53**	.26**	.54**	.64**	.57**	.53**
4. FSS	3.52	.92	.88				.47**	.14	.56**	.61**	.69**	.51**
5. SFWS	2.74	.66	.76					.16	.32**	.35**	.30**	.53**
Time 2												
6. FMQ-1	3.47	.45	.75						.40**	.25*	.18	.28**
7. FMQ-2	2.45	.67	.87							.56**	.57**	.55**
8. SDFS-2	3.62	.49	.82								.79**	.70**
9. FSS	3.68	.95	.91									.72**
10. SFWS	2.73	.63	.81									-

Notes. N = 101. Measure Labels: FMQ-1 Beliefs that Flow Fosters Achievement; FMQ-2 Confidence in Ability to Self-Regulate Flow; SDFS-2 Short Dispositional Flow Scale-2; FSS Flow Short Scale; SFWS Short Flow in Work Scale. * $p < .05$; ** $p < .01$.

6.5.2 Beliefs that Flow Fosters Achievement (FMQ-1) and Flow at Work

Table 11 shows the goodness-of-fit indices for the competing structural equation models of the flow metacognition Beliefs that Flow Fosters Achievement (FMQ-1) and flow at work. The results were virtually the same for each of the three measures of flow. The chi-square test of each model was significant indicating that all models did not fit strictly. However, the goodness-of-fit indices (RMSEA, CFI, NNFI) indicated reasonably close fit for the models that used the SDFS-2, the SFWS and the FSS to measure flow. For all three measures of flow, Models 2, 3, and 4 did not fit significantly better than Model 1, the stability model, as revealed by nonsignificant chi-square difference tests (results not shown). The analysis concluded that there was no causal path from Beliefs that Flow Fosters Achievement (FMQ-1) to flow (as measured by the three measures flow).

Table 11: Goodness-of-fit indices for the competing structural equation models of the flow metacognition Beliefs that Flow Fosters Achievement (FMQ-1) and flow at work measured using three different scales

Model	χ^2	*df*	*p*	*RMSEA*	*CFI*	*NNFI*
Short Dispositional Flow Scale-2 (SDFS-2)						
Model 1: Stability model	475.96	387	.001	.048	.95	.95
Model 2: Causality model	473.88	386	.002	.048	.95	.95
Model 3: Reversed causality model	475.62	386	.001	.048	.95	.94
Model 4: Reciprocal model	473.46	385	.001	.048	.95	.95
Flow Short Scale (FSS)						
Model 1: Stability model	594.51	445	.000	.058	.95	.95
Model 2: Causality model	594.51	444	.000	.058	.95	.95
Model 3: Reversed causality model	594.51	444	.000	.058	.95	.95
Model 4: Reciprocal model	594.51	443	.000	.058	.95	.95
Short Flow in Work Scale (SFWS)						
Model 1: Stability model	156.70	123	.022	.052	.97	.96
Model 2: Causality model	156.69	122	.019	.053	.97	.96
Model 3: Reversed causality model	156.24	122	.012	.053	.97	.96
Model 4: Reciprocal model	156.16	121	.017	.054	.97	.96

Notes. $N = 101$. χ^2 = chi-square; *df* = degrees of freedom; *RMSEA* = Root Mean Square Error of Approximation; *CFI* = Comparative Fit Index; *NNFI* = Non-Normed Fit Index

6.5.3 Confidence in Ability to Self-Regulate Flow (FMQ-2) and Flow at Work

Table 12 shows the goodness-of-fit indices for the competing structural equation models for the flow metacognition Confidence in Ability to Self-Regulate Flow (FMQ-2) and flow at work. When flow was measured by the SDFS-2, the chi-square test of models 1 and 3 were significant indicating that these two models did not fit strictly. However, the goodness-of-fit indices indicated close fit for all four models. The causality model (Model 2) outperformed the stability model, indicating that there was a lagged effect of FMQ-2 at time 1 on flow at work at time 2 (Delta $\chi^2(1) = 4.02$, $p = .045$). The reversed causality model (Model 3) did not outperform the stability model indicating that there was no reversed lagged relationship (Delta $\chi^2(1) = 1.70$, $p = .19$). Finally, the reciprocal model (Model 4) outperformed both the stability model (Delta $\chi^2(2) = 6.26$, $p = .044$) and the reversed causality model (Delta $\chi^2(1) = 4.56$, $p = 0.033$) but did not outperform the causality model (Delta $\chi^2(1) = 2.24$, $p = 0.13$). In all, the causality model was the best fitting and most parsimonious model out of the four models tested and thereby supported the hypothesis for flow measured by the SDFS-2.

Table 12: Goodness-of-fit indices for the competing structural equation models of the flow metacognition Confidence in Ability to Self-Regulate Flow (FMQ-2) and flow at work measured using three different scales

Model	χ^2	*df*	*p*	RMSEA	CFI	NNFI
Short Dispositional Flow Scale-2 (SDFS-2)						
Model 1: Stability model	458.06	387	.007	.043	.97	.96
Model 2: Causality model	454.04	386	.010	.042	.97	.96
Model 3: Reversed causality model	456.36	386	.008	.043	.97	.96
Model 4: Reciprocal model	451.80	385	.011	.042	.97	.96
Flow Short Scale (FSS)						
Model 1: Stability model	582.15	445	.000	.056	.97	.97
Model 2: Causality model	577.28	444	.000	.055	.97	.97
Model 3: Reversed causality model	582.15	444	.000	.056	.97	.97
Model 4: Reciprocal model	577.28	443	.000	.055	.97	.97
Short Flow in Work Scale (SFWS)						
Model 1: Stability model	158.57	123	.017	.054	.98	.98
Model 2: Causality model	146.25	122	.067	.045	.99	.99
Model 3: Reversed causality model	158.57	122	.014	.055	.98	.98
Model 4: Reciprocal model	146.25	121	.059	.046	.99	.99

Notes. N = 101. χ^2 = chi-square; *df* = degrees of freedom; *RMSEA* = Root Mean Square Error of Approximation; *CFI* = Comparative Fit Index; *NNFI* = Non-Normed Fit Index.

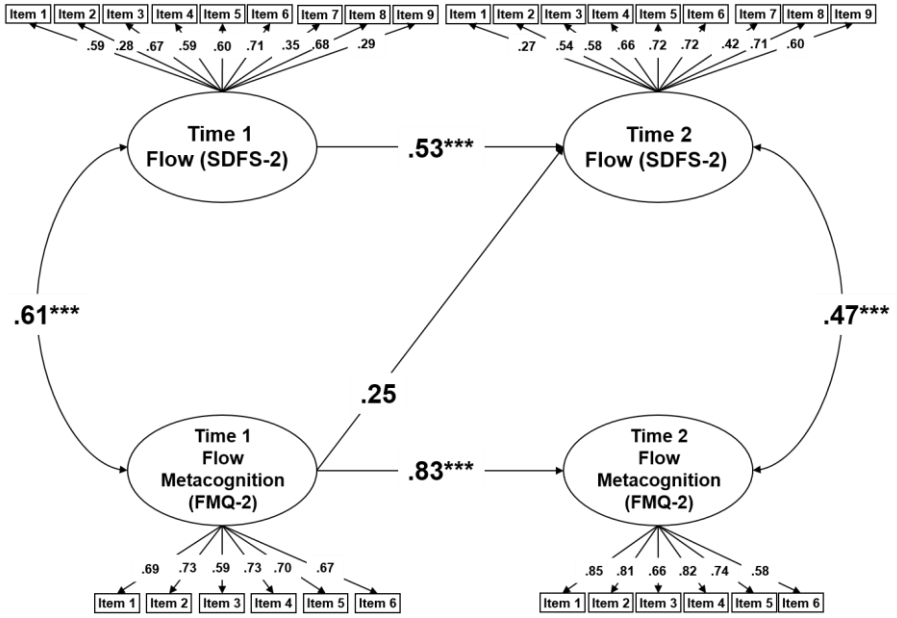
When flow was measured by the FSS, the chi-square test of each model was significant indicating that all four models did not fit strictly. However, the goodness-of-fit indices indicated close fit for all four models. The causality model (Model 2) outperformed the stability model, indicating that there was a lagged effect of FMQ-2 at time 1 on flow at work at time 2 (Delta $\chi^2(1) = 4.87$, $p = 0.027$). The reversed causality model (Model 3) did not outperform the stability model indicating that there was no reversed lagged relationship (Delta $\chi^2(1) = .00$, $p = 1.00$). Finally, the reciprocal model (Model 4) outperformed the reversed causality model (Delta $\chi^2(1) = 4.87$, $p = 0.027$), but did not outperform the stability model (Delta $\chi^2(2) = 4.87$, $p = .088$) and the causality model (Delta $\chi^2(1) = .00$, $p = 1.00$). In all, the causality model was the best fitting and most parsimonious model out of the four models tested and thereby the hypothesis was supported for flow measured by the FSS.

When flow was measured by the SFWS, the chi-square test of all four models were nonsignificant, indicating that these models fitted. The goodness-of-fit indices also indicated close fit for all four models. The causality model (Model 2) outperformed the stability model, indicating that there was a lagged effect of FMQ-2 at time 1 on flow at work at time 2 (Delta $\chi^2(1) = 12.32$, $p = 0.00045$). The reversed causality model (Model 3) did not outperform the stability model indicating that there was no reversed lagged relationship (Delta $\chi^2(1) = .00$, $p = 1.00$). Finally, the reciprocal model (Model 4) outperformed both the stability model (Delta $\chi^2(2) = 12.32$, $p = 0.0021$ and the reversed causality model (Delta $\chi^2(1) = 12.32$, $p = 0.00045$) but did not outperform the causality model (Delta $\chi^2(1) = .00$, $p = 1.00$). In all, the causality model was the best fitting and most parsimonious model out of the four models tested and thereby the hypothesis was supported for flow measured by the SFWS.

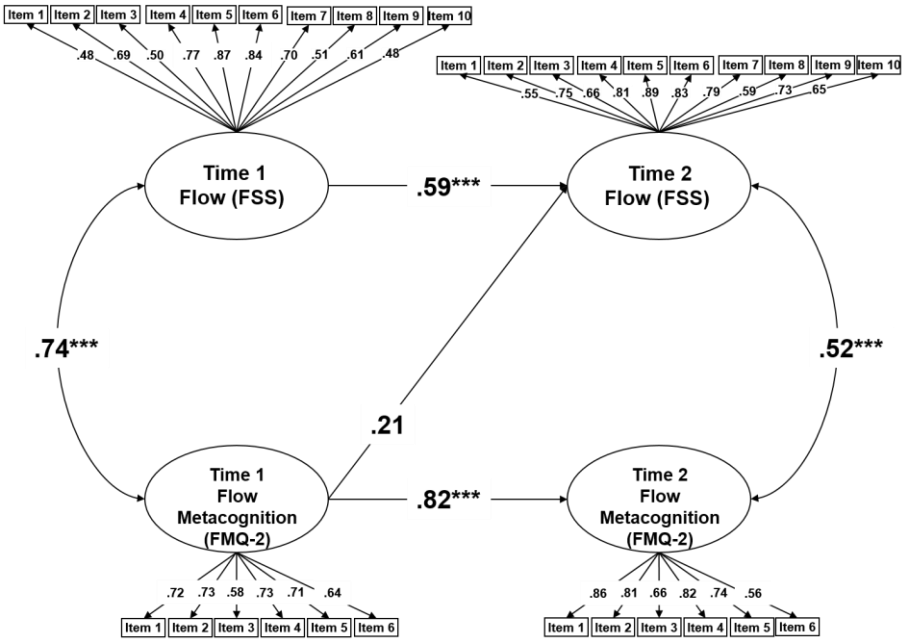
Figure 6 shows the estimated causal model, with standardised path coefficients and factor loadings of the latent variables, for FMQ-2 and flow measured by (a) the SDFS-2, (b) the FSS, and (c) the SFWS. Model (a) explained 68% of the variance in FMQ-2 and 50% of the variance of flow at work measured by the SDFS-2. Model (b) explained 67% of the variance in FMQ-2 and 57% of the variance of flow at work measured by the FSS. Model (c) explained 67% of the variance in FMQ-2 and 57% of the variance of flow at work measured by the SFWS. In all three models the crossed-lagged path from FMQ-2 to flow is positive. The path is strongest for model (c).

It should be pointed out that the model fit indices were similar, particularly for model 2 and model 4, with the best fitting and most parsimonious model (model 2) being chosen. Based on z-tests (see footnote 12), the causal path for model (c) in Figure 6 was significant (at the two-tailed significance level), the relationship was also significant for model (a) when tested one-tailed and was also approaching significance for model (b) when tested one-tailed. Findings based on the chi-square difference were also similar (with slight differences to the z-tests in the strength of the significance which can be attributed to the small sample size and rounding errors in estimation algorithms). In all, the causality model (Model 2) outperformed the stability model for all three measures of flow, indicating that there was a lagged effect of FMQ-2 at time 1 on flow at work at time 2.

(a) SDFS-2


Item 1 Item 2 Item 3 Item 4 Item 5 Item 6 Item 7 Item 8 Item 9
.59 .28 .67 .59 .60 .71 .35 .68 .29
Item 1 Item 2 Item 3 Item 4 Item 5 Item 6 Item 7 Item 8 Item 9
.27 .54 .58 .66 .72 .72 .42 .71 .60
Time 1 Flow (SDFS-2)
.53***
Time 2 Flow (SDFS-2)
.61***
.47***
.25
Time 1 Flow Metacognition (FMQ-2)
.83***
Time 2 Flow Metacognition (FMQ-2)
.69 .73 .59 .73 .70 .67
Item 1 Item 2 Item 3 Item 4 Item 5 Item 6
.85 .81 .66 .82 .74 .58
Item 1 Item 2 Item 3 Item 4 Item 5 Item 6

(b) FSS


Item 1 Item 2 Item 3 Item 4 Item 5 Item 6 Item 7 Item 8 Item 9 Item 10
.48 .69 .50 .77 .87 .84 .70 .51 .61 .48
Item 1 Item 2 Item 3 Item 4 Item 5 Item 6 Item 7 Item 8 Item 9 Item 10
.55 .75 .66 .81 .89 .83 .79 .59 .73 .65
Time 1 Flow (FSS)
.59***
Time 2 Flow (FSS)
.74***
.52***
.21
Time 1 Flow Metacognition (FMQ-2)
.82***
Time 2 Flow Metacognition (FMQ-2)
.72 .73 .58 .73 .71 .64
Item 1 Item 2 Item 3 Item 4 Item 5 Item 6
.86 .81 .66 .82 .74 .56
Item 1 Item 2 Item 3 Item 4 Item 5 Item 6

(c) SFWS

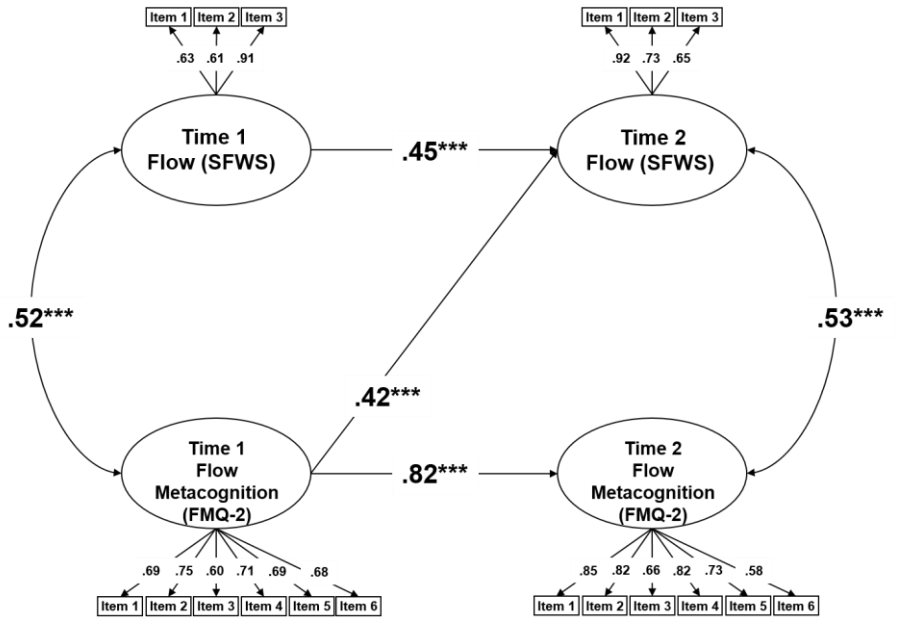


Figure 6: Estimated causal models, with standardised path coefficients and factor loadings of the latent variables, for FMQ-2 and flow measured by (a) the SDFS-2, (b) the FSS, and (c) the SFWS[12]

6.5.4 Sensitivity Analyses

Sensitivity analyses were conducted to assess if these findings also held for sample sub-groups. Two groups were constructed, a sample of 'pure' work flow-ers (n = 52), i.e. participants who reported their most intense flow experience during a

[12] Two-tailed and one-tailed p-values were computed in SPSS using the cumulative distribution function with the t-distribution being approximated by the standard normal distribution. The asterisks in Figure 6 present the two-tailed significance levels and one-tailed levels are presented below.

For Figure 6 (a) SDFS-2: Stability path from 'Time 1 Flow' to 'Time 2 Flow': $z = 3.36$, $p < 0.001$; stability path from 'Time 1 Flow Metacognition' to 'Time 2 Flow Metacognition': $z = 7.32$, $p < 0.001$ (one-tailed); causal path: $z = 1.89$, $p = 0.029$. The causal path is significant.

For Figure 6 (b) FSS: Stability path from 'Time 1 Flow' to 'Time 2 Flow': $z = 3.59$, $p < 0.001$; stability path from 'Time 1 Flow Metacognition' to 'Time 2 Flow Metacognition': $z = 7.49$, $p < 0.001$; causal path: $z = 1.56$, $p = 0.059$. The causal path approaches significance.

For Figure 6 (c) SFWS: Stability path from 'Time 1 Flow' to 'Time 2 Flow': $z = 3.74$, $p < 0.001$; stability path from 'Time 1 Flow Metacognition' to 'Time 2 Flow Metacognition': $z = 7.18$, $p < 0.001$; causal path: $z = 3.60$, $p = 0.001$. The causal path is significant.

work activity at both points in time, and a group of 'mixed' leisure and work flow-ers, i.e. participants who reported a leisure activity at least at one point in time (n = 49). For the SDFS-2, standardised estimates of the causal path from FMQ-2 at time 1 to flow at time 2 were .32 for the group of work flow-ers and .24 for the mixed flow-ers. For the FSS, these were .22 for work-flowers and .28 for mixed flow-ers. For the SFWS, standardised estimates were .44 for work flow-ers and .38 for mixed flow-ers. Overall, the strength of the causal path between FMQ-2 and flow at work appeared to be similar for both groups but somewhat dependent on the measure of flow at work, i.e. the causal path was strongest for flow at work measured by the SFWS, followed by the SDFS-2, and the FSS.

6.6 Discussion

This study tested the longitudinal relationship between flow metacognition (FMQ-2) and flow in work, based on a sample of international workers. It was hypothesised that Confidence in Ability to Self-Regulate Flow (FMQ-2) would foster flow, thus supporting a causal relationship. The analysis was also repeated for Beliefs that Flow Fosters Achievement (FMQ-1) for explanatory purposes. The stabilities of flow at work and flow metacognitions over time were also assessed. Based on test-retest reliabilities between T1 and T2, Confidence in Ability to Self-Regulate Flow (FMQ-2), was found to be relatively stable over the studied time period. This finding is in line with maladaptive metacognitions (e.g. Wells & Cartwright-Hatton, 2004). Furthermore, the research hypothesis was largely confirmed for Confidence in Ability to Self-Regulate Flow, which at time 1 significantly predicted the intensity of flow at work at time 2. People's confidence in the self-regulation of flow appears to be a more stable, trait-like characteristic, which is causally linked to work flow months later. It appears that if one is confident that

one can ‘make flow happen’ in one situation, this confidence transfers to future situations as well.

FMQ-1 (Beliefs that Flow Fosters Achievement) was found to be less stable. The results indicate that these beliefs were more situation- or task-dependent rather than trait-like. A number of potential reasons could explain the temporal instability of the FMQ-1 subscale. It may indicate that FMQ-1 is better defined as a state variable predominantly influenced by the properties of the task. Therefore, a high FMQ-1 score at time 1 relating to beliefs about the usefulness of flow during a specific task would not necessarily predict the intensity of one’s more global flow at work at time 2. Further, the activation of these metacognitive beliefs may also be largely task dependent. For example, if one is engrossed in a complex work task, beliefs about the usefulness of flow for enhancing achievement may be adaptive. However, if one experiences flow during a more routine task, these beliefs may be largely inconsequential for preforming the task as pushing for excellence may not be necessary. Research supported the notion that flow is possible during routine work tasks, albeit with lower probability compared to jobs which provide greater opportunity for creativity (Moneta, 2012a). Task importance has also been found to moderate the relationship between flow antecedents, specifically the ratio of demands and skills and flow (Engeser & Rheinberg, 2008). It would therefore be useful to understand whether the relative importance of the task also moderates the relationship between flow metacognitions, in particular FMQ-1, and flow at work.

Furthermore, the reverse causation (i.e. flow at time 1 did not predict flow metacognition at time 2) was not supported for either flow metacognition (FMQ-1 and FMQ-2), indicating that flow at work did not predict people’s subsequent beliefs about flow. Given that flow metacognition (FMQ-2) was found to predict flow at T2,

but no evidence was found for the reciprocal case, Confidence in Ability to Self-Regulate Flow (FMQ-2) could be described as an antecedent, rather than a consequence of flow.

6.7 Study Strengths and Limitations

The study's main strength was its longitudinal design, albeit with a limited follow up time, which made it possible to assess potentially directional relationships between the study variables. However, the main weaknesses, despite significant results, were the limited sample size and homogeneity of the study sample of highly educated individuals. This might potentially affect the study's external validity by reducing the generalisability of the results. Results should, therefore, be replicated with a more diverse sample.

Chapter 7: Discussion and Conclusions

7.1 Summary and Main Findings

The theoretical basis of this research was grounded in Csikszentmihalyi's (2000) theory of flow and its potential links to theories of maladaptive metacognitions as identified by Wells and co-workers (e.g. Wells, 2000, 2012; Wells & Matthews, 1994) and adaptive metacognitions (Beer, 2011; Beer & Moneta, 2010, 2012b). The overall aim of this PhD research was to identify a new construct, flow metacognitions, which to the best knowledge of the author had not been described or tested in the academic literature to date. In order to achieve this aim, a sequence of research studies, each building upon the others, was conducted. Going back to first principles, as Csikszentmihalyi had done in order to identify flow, qualitative analyses were conducted (Study 1). Based on these analyses, two broad metacognitive constructs were identified in relation to flow, i.e. people's beliefs in the usefulness of flow and people's confidence in the self-regulation of flow. In order to go beyond mere description, a bespoke measure of flow metacognitions, the Flow Metacognitions Questionnaire (FMQ), was developed and validated based on a pilot questionnaire in Study 2. Further validation in Study 3 led to a parsimonious and psychometrically sound 12-item measure with two underlying components, Beliefs that Flow Fosters Achievement (FMQ-1) and Confidence in Ability to Self-Regulate Flow (FMQ-2). Having developed a tool to measure flow metacognitions made it possible to test them and their potential impact on the intensity and frequency of flow. Results presented in Study 3, found that Confidence in Ability to Self-Regulate Flow (FMQ-2) predicted the intensity of flow controlling for general

metacognitions (adaptive and maladaptive), as well as the frequency of flow above measures of the intensity of flow (as well as measures of adaptive and maladaptive metacognitions). Furthermore, a longitudinal analysis presented in Study 4 established that the FMQ-2 had good temporal stability lending support to its conceptualization as a dispositional, trait-like construct, whereas FMQ-1 appeared to be less stable, suggesting that situational circumstances influenced this factor. Furthermore, Study 4 provided initial evidence of a causal relationship between FMQ-2 and flow, as FMQ-2 predicted dispositional flow in work longitudinally.

In summary, the research carried out as part of this PhD dissertation was successful in the identification of flow metacognitions, that were found to have behavioural consequences on flow (as in the case of FMQ-2). Further, it contrasted findings on people's beliefs in the potentially positive consequences of flow with people's confidence in the self-regulation of flow experiences.

7.2 Theoretical Basis

Flow theory by Csikszentmihalyi (1997/2000) provided the starting point for this research, with the overall aim being the identification of a new construct, flow metacognitions. Metacognitions had been described as 'thinking about thinking' or 'cognitions about cognitions', encompassing, metacognitive knowledge, monitoring, and control of cognitive processes (Dunlosky & Metcalfe, 2009). Although flow could be regarded as a cognitive state of simultaneous centring of attention, loss of self-consciousness, and merging of action and awareness, the potentially important aspects of metacognitions on flow, had to date not been investigated. Both metacognitive knowledge and control appeared to be particularly relevant in the context of flow research. Metacognitive knowledge 'about more general thinking

often constitutes a person's *lay theories* about his or her own thinking' (Briñol & DeMarree, 2012, p. 2). As described by Briñol and DeMarree (2012), such lay theories could constitute e.g. that 'moods affect thinking' (p. 2). In the case of 'thinking about flow' as a cognitive state, people may also have held certain lay theories, such as knowledge about the circumstances and strategies under which they achieved flow more easily (e.g. in certain surroundings, during certain tasks, as well as having certain strategies for entering into flow more easily, such as minimising interruptions) as well as the positive consequences of flow. Metacognitive control was described as 'regulating one's thinking'. In the context of flow, for example, one may try to focus more intensely on the task at hand in order to get into flow.

The concept of metacognitions has been researched in a range of psychological fields. Most importantly to this PhD were the theoretical models of maladaptive metacognitions in clinical psychology (e.g. Wells, 2000, 2012; Wells & Matthews, 1994), as well as adaptive metacognitions in the field of positive psychology (Beer, 2011; Beer & Moneta, 2010, 2012a). Maladaptive metacognitions were found to be causally linked to detrimental and continuing effects on vulnerable people's mental health. Based on the Self-Regulatory Executive Function (S-REF) model, maladaptive metacognitions fostered a cognitive attentional syndrome (CAS), that was activated by negative emotions or thoughts in response to stressful situations (Wells, 2000; Wells & Matthews, 1994). The CAS was characterized by a maladaptive thinking style that included the dysfunctional use of attention, rumination and worry, and maladaptive coping efforts such as threat monitoring, rumination, and thought suppression (Wells, 2012). The CAS ultimately could lead to intensifying of distressing emotions. Overall, prolonged S-REF activity could lead to the disruption or prevention of adaptive cognitive processes, including adaptive

self-regulation and coping (Beer, 2011; Wells, 2000). Furthermore, maladaptive metacognitions were described as relatively stable and trait-like, yet, amenable by metacognitive therapy interventions. As Wells (2008) highlighted, in contrast to cognitive behavioural therapy approaches, metacognitive therapy aimed to alter the content of metacognitions rather than the content of cognitions.

Most recently, Beer and Moneta (2011) identified adaptive metacognitions. These were found to be activated during demanding situations, and, in the absence of maladaptive metacognitions, the three adaptive metacognitive traits (i.e. Confidence in Extinguishing Perseverative Thoughts and Emotions; Confidence in Interpreting Own Emotions as Cues, Restraining from Immediate Reaction and Mind-Setting for Problem-Solving; and Confidence in Setting Flexible and Feasible Hierarchies of Goals) were found to foster adaptive coping efforts and were negatively related to perceived stress. Beer (2011) suggested that these three psychological dimensions could be 'represented as a crucial successive sequence of cognitive, emotional, and behavioural processes' (p. 217). Therefore, the three adaptive metacognitive traits could be thought of as a three stage model of adaptive functioning during demanding situations. During the initial phase of encountering a stressful situation one may not yet react adaptively to the situation and engage in perseverative thinking. However, people who score highly on the Confidence in Extinguishing Perseverative Thoughts and Emotions (PMCEQ-1) trait manage to extinguish these thoughts. They are then able, during the second stage, to move on to a state of mindful suspension of judgement of the situation, as well as focusing their mind on problem-solving (Confidence in Interpreting Own Emotions as Cues, Restraining from Immediate Reaction and Mind-Setting for Problem-Solving, PMCEQ-2). During the final stage, people exhibit a Confidence in Setting Flexible and Feasible Hierarchies of Goals

(PMCEQ-3), by planning and restructuring the goals and making the task more manageable. Successful coping efforts may conclude after the third stage in this process, without necessarily resulting in flow. However, under certain circumstances (e.g. taking the example of surgeons and medical staff presented in Study 1, this may happen when one has sufficient expertise), successful coping with the demands of a situation may lead to the experience of flow. It is therefore proposed that a fourth stage, the activation of flow metacognitions, could be added to this model. In order to activate flow metacognitions, perseverative thinking and rumination would need to have been stopped first (i.e. Confidence in Extinguishing Perseverative Thoughts and Emotions), emotions would have been evaluated as cues for action, a mind setting for problem solving would have been adopted (i.e. Confidence in Interpreting Own Emotions as Cues, Restraining from Immediate Reaction and Mind-Setting for Problem-Solving), and goals would have been flexibly restructured (i.e. Confidence in Setting Flexible and Feasible Hierarchies of Goals). As outlined in Chapter 1, people's Confidence in Setting Flexible and Feasible Hierarchies may impact on the 'regulatory compatibility', i.e. the perceived interaction of person (i.e. skills) and situational (i.e. demands) variables. This adaptive metacognitive trait may therefore be implicated in the balance of perceived demand and skills, an important antecedent of the flow experience. In addition to adaptive metacognitions, flow metacognitions in terms of people's confidence in the self-regulation of flow may also be activated at this stage. These may also impact on the demand–skills balance (as moderate correlations between PMCEQ-3 and FMQ-2 were found). However, it is also believed that flow metacognition may impact on other components of flow, in particular, the centring of attention, loss of self-consciousness, and merging of action and awareness, as flow metacognition (FMQ-2) was found to be most predictive of

these components in the longitudinal analysis of Study 4. However, the underlying processes are only hypothesised at this stage and need to be understood more fully, as described under limitations and outlook for future research.

7.3 Beliefs that Flow Fosters Achievement

This research found that people held positive metacognitive beliefs about the potential consequences of flow. To some extent it is unsurprising that people hold positive beliefs on flow, as a number of studies confirmed (direct and indirect) links between the positive consequences of flow in relation to a range of achievement contexts that included sports (e.g. Bakker et al., 2011; Jackson, Thomas, Marsh, & Smethurst, 2001; Partington et al., 2009), artistic expression (Byrne, MacDonald, & Carlton, 2003), work (Demerouti, 2006), and education (Chu, 2012). For example, flow mediated the relationship between environmental resources and coach-rated performance in a sample of Dutch soccer players; furthermore team flow was reported to be higher during draws and wins than during losses (Bakker et al., 2011), which supported a link between flow and performance in competitive sports. Others even concluded that in sports 'flow may make the difference between a good performance and a great performance' (Jackson & Roberts, 1992, p.168). In the context of artistic expression, Byrne et al. (2003) reported a positive association between flow and creativity ratings of musical compositions. Furthermore, Fullagar et al. (2013) found that the state of flow was incompatible with performance anxiety in a sample of student musicians. In the context of work, Demerouti (2006) reported a link between flow at work, as measured by the WOLF (Bakker, 2008), which operationalised flow as the simultaneous experience of enjoyment, absorption, and intrinsic motivation in work tasks, and performance. However, this finding was moderated by the personality variable conscientiousness and, therefore, flow was

only related to increased intra- and extra-role performance for those workers who were highly conscientious. Demerouti (2006) proposed a situational approach in order to elicit flow, i.e. making work environments more flow conducive by 'creating flow-evoking working conditions through work (re)design approaches' (p. 277). A study of work performance of elementary school teachers provided similar results, and also reported a moderating role of conscientiousness as well as emotional stability on flow and performance (Chu, 2012). These findings suggest that, although relationships between flow and performance in a range of contexts have been reported, these are not necessarily always direct, and may be mediated by situational as well as personal variables.

As noted, given these reports of the positive consequences of flow, as well as the relative availability of literature on flow in the popular press, it is perhaps not surprising that people's beliefs on the positive consequences of flow in relation to achievement were identified as a metacognitive belief on flow as a state of optimal cognitive functioning. These beliefs, Beliefs that Flow Fosters Achievement (as measured by the six items of the FMQ-1 subscale), capture people's beliefs on the positive consequences of flow in terms of achievement, task focus, and creativity. Furthermore, FMQ-1 was found to be positively associated with flow, but did not predict the intensity or frequency of flow after controlling for FMQ-2. Interestingly, these beliefs do not appear to directly affect people's flow experiences. A number of reasons could account for this finding. First, any effects of this flow metacognition may not be directly affecting flow. It is conceivable that other variables may moderate a relationship between flow metacognition and flow. For example, Moneta (2012a) found that the relationship between trait intrinsic motivation and flow was moderated by the opportunity for creativity a job offered. Opportunity for creativity

may also moderate a potential relationship between FMQ-1 and flow in work. It could be hypothesised that for people who hold positive beliefs on flow's potential to foster achievement, these beliefs would only affect cognitive processes, i.e. work flow, if their work actually offered opportunities for achievement, such as an outlet for creativity. In other contexts, e.g. when one's work does not offer these opportunities, this metacognition may be largely inconsequential. Second, a possible interpretation is that metacognitive beliefs as measured by the FMQ-1 subscale could be described by a more general attitude people may hold toward flow – in particular, the cognitive component of an attitude that being in flow could lead to positive consequences. As known from social psychology research, attitudes are not necessarily good predictors of actual outcomes (Aronson, Wilson, & Akert, 2016).

Third, Jackson and Roberts (1992), who described flow research as part of a social cognitive approach to achievement behaviour, distinguished between process oriented and outcome oriented athletes and the effects these orientations had on peak performance. Based on a sample of 200 college athletes it was found that being outcome focused (i.e. overly concerned with the outcome of their performance) was a marker of their worst performance, while athletes during their best performances usually focused on the process itself and compared their performance to personal bests rather than other competitors. This finding also provides parallels to the two flow metacognitive factors as identified as part of this PhD research. Similar to being outcome focused, having a belief in the positive outcome or consequences of flow experiences does not necessarily aid people's flow experiences. In contrast, holding metacognitions that focus more on the process of initiating and sustaining flow (i.e. being process focused) and being confident in the self-regulation of one's flow experiences, is predictive of flow.

Fourth, the underlying mechanisms between flow metacognitions and flow can only be hypothesised at this stage. For example, people's belief in the positive consequences of flow may be activated during demanding situations. Yet, if people do not have the 'tool' of self-regulating flow, they would probably be unlikely to experience flow. Therefore, it would be important to understand, particularly given the lack of temporal stability of the FMQ-1, any moment-to-moment variations in people's flow metacognitions as well as flow experiences. Furthermore, Csikszentmihalyi has pointed out that the importance of flow does not lie within its positive after-effects but in the intrinsic enjoyment of the task itself. Even though the research presented as part of this PhD found that people may hold beliefs about flow and achievement, it appears to not have any direct effects on their flow experiences, at least as studied, in the context of work. This main negative finding, could be viewed as supportive of this core tenet of flow theory.

A number of limitations in relation to the FMQ-1 subscale need to be discussed. First, participants' agreement with the items measuring FMQ-1 was relatively high (i.e. an average of 3.5 out of 4 as reported in Table 6 and Table 10), which may indicate low discriminability of this scale between participants. A possible reason for this response pattern could be social desirability effects (Choi & Pak, 2005; Cook, 2010). Second, the concept of flow has been well known and widely accessible in the popular literature now for over 40 years. It is very likely that a number of participants who contributed to this research may have read about flow in the past. Titles such as *Flow in sports: they keys to optimal experiences and performances* (Jackson & Csikszentmihalyi, 1999), *Creativity: Flow and the psychology of discovery and invention* (Csikszentmihalyi, 1997), and *Good business: leadership, flow, and the making of meaning* (Csikszentmihalyi, 2003) naturally

suggest links between flow and achievement, such as enhanced performance, creativity, and invention. This prior knowledge may have influenced people in responding more positively to the items on flow and achievement in the FMQ-1. However, prior knowledge of flow was not assessed and therefore not controlled for in the analyses.

Third, the items included in the FMQ-1 sub-scale may confound a core condition of flow (i.e. task focus, 'clearer thinking'), with potential positive consequences of flow (such as generation of ideas, creativity, and enhanced achievement). Yet, the internal consistency of the FMQ-1 sub-scale was found to be acceptable and would support the notion that the items included in the FMQ-1 sub-scale conceptually belonged together.

However, the main negative finding of a lack of a causal relationship between people's beliefs in flow fostering achievement, opens up important implications for furthering the knowledge of flow in work contexts. Particularly, when put into context with the second metacognitive factor identified, i.e. Confidence in Ability to Self-Regulate Flow (as measured by the FMQ-2 subscale), it can be concluded that flow experiences cannot be furthered by enhancing people's beliefs in the positive consequences of this state. It is important that people actually have the 'tools' for achieving flow, as identified by the second metacognitive factor.

7.4 Confidence in the Self-Regulation of Flow

The main positive finding of this PhD research, particularly in combination with the main negative finding, was that people's Confidence in Ability to Self-Regulate Flow (as measured by the FMQ-2 subscale) predicted the intensity and frequency of flow and that, furthermore, longitudinal analysis established a causal

mechanism between this flow metacognition and flow at work. In contrast to FMQ-1, this metacognitive factor appears to directly affect the cognitive optimal experience that is flow. Particularly given that the causal link between flow metacognitions and flow was strongest for flow measured according to the SFWS, it could be assumed that this metacognition functions by impacting directly on the components of flow (in particular loss of self-consciousness; centring of attention, and merging of action and awareness), rather than indirectly, via the antecedents of flow. As outlined in Chapter 1, adaptive metacognitions were expected to promote flow. This research confirms the link between flow and adaptive metacognitions, corroborating earlier preliminary findings by Moneta (2015). This provides an explanation for an important individual difference dimension in the experience of flow, as well as advancing the understanding of the concept of the autotelic personality. Commenting on the autotelic personality, Baumann (2012) noted that 'unfortunately, the rich concept was not complemented by an adequate operationalization' (p. 165). However, this research has provided an important theoretical advancement with regards to its operationalisation. Furthermore, and most importantly, the main negative and positive findings of this research need to be viewed in conjunction, particularly when aiming to understand flow in the context of work. It follows that fostering people's confidence to self-regulate flow will be more fruitful in in terms of their experience of flow in work than enhancing their beliefs in the positive consequences of flow. As described in Chapter 5, this implication may appear counterintuitive. The analogy of the '5 A DAY' initiative was used to illustrate the difference between the two flow metacognitive factors and their potential consequences on the experience of flow. A general belief in the usefulness of consuming fruit and vegetables (or, related to flow, a belief in the usefulness of

being in flow) may not be sufficient to eat healthily (or experience flow). However, having the tools to shop for healthy food and to prepare it in a nutritious way (or, having knowledge of the tools necessary to self-regulate flow experiences) makes the adoption of a healthy lifestyle (and the experience of flow) much more likely.

However, as discussed in the limitations and outlook for future research, the underlying processes would need to be investigated further. It could be e.g. that people who hold this metacognition, i.e. score highly on FMQ-2, deliberately direct their attention to a limited stimulus field (in order to increase focused attention), or that they self-regulate flow by controlling external factors, such as limiting distractions. These self-regulation processes could also be relatively automatic. For example, Koole, Jostmann, and Baumann (2012) commented that self-regulation usually comprised 'conscious and effortful control of behavior' (p. 329) but that their use of the self-regulation construct may also include more automatic processes. This conceptualisation appears to be particularly relevant for flow experiences. Although the underlying processes of the self-regulation need to be more fully understood, it could be implied that self-regulation of flow does not necessarily need to be effortful and that it could also proceed relatively automatically. As pointed out earlier, relatively little research has been reported previously on the self-regulation of flow experiences, particularly in demanding situations. For example, Jackson and Csikszentmihalyi (1999) commented that 'being able to convert the stressors into challenge becomes the key to flow' (p. 17). In parallel to the qualitative findings on flow as a way of coping as described in Study 1, the following quote by a cyclist illustrates the transformation of stress into a challenge and this athlete's awareness that this process elicits flow:

> I think there's a certain point at which you can convert stressful situations to challenge – rather than stressful things – which is where the flow sort of triggers off and you go, and it is like nothing is going to get in the way. (interview of cyclist, Jackson and Csikszentmihalyi, 1999, p. 19)

In the context of sports, qualitative research documented that a large proportion of athletes found flow controllable (Chavez, 2008; Jackson, 1992). The following quote by Chavez (2008) highlights that flow researchers disagreed on the self-regulation of flow but also illustrates the importance of better understanding factors implicated in the potential volitional control of flow:

> Many investigators believe that these states [flow] may be voluntarily controlled or can be increased in frequency and intensity while other investigators believe they 'just happen'. If flow is indeed a controllable state, capable of being conditioned under volitional will, it would be important to examine the psychological and physiological factors that are involved during this process. As such, studies are needed to investigate the type of overt and covert psychological factors, if any, that may contribute to the frequency with which one experiences flow, particularly relative to athletic performance. (Chavez, 2008, p. 71)

Furthermore, Baumann (2012) spoke of the 'important role of self-regulation in flow' (p. 169) and commented that self-regulation competencies as an individual difference component in experiencing flow was directly assessed by the research of Keller and Blomann (2008) and Keller and Bless (2007). They experimentally measured the effects of regulatory compatibility as operationalised by the interaction of person (i.e. skills) and situational (i.e. demands) variables. In particular, Keller and Blomann (2008) found that people's locus of control orientation (LOC, Rotter, 1966), i.e. a general tendency to perceive oneself in control of one's actions and their outcomes, moderated the experience of flow under demand and skills compatibility. Participants high in internal locus of control experienced flow under regulatory compatibility of demands and challenges, whereas a low internal locus of control

was not predictive of flow. Furthermore, Keller and Bless (2007) found people high in action-orientation responded more sensitively to matching skills and demands. Action-orientation is a personality construct developed by Kuhl (1994), which appears to be particularly relevant to flow research. Action-oriented people are able to stay immersed in an activity whereby state-oriented people are characterised by an over-function of the action initiation system, and, therefore are getting distracted easily during task performance. This flow relevant component of action-orientation can be measured by the 'volatility' sub-scale of the Action Control Scale (ACS-90),[13] based on 'items that assess the ability to stay within self-initiated and pleasant activities without shifting prematurely to alternative activities' (Kuhl, 1994, p. 53).

Given that there is some limited evidence on factors which may affect people's self-regulation of flow, it would enhance flow theory, to understand any potential links between these factors, such as locus of control and action-orientation, with regard to people's confidence in the self-regulation of flow. It could be hypothesised that people who are confident in 'making flow happen' would be more action oriented, i.e. more able to stay engrossed in a task and fend off distractions, as well as having a higher internal locus of control, i.e. 'a special sensitivity to the degree to which one's effort and/or capabilities determine experienced outcomes' (Keller & Bless, 2007, p. 603).

In addition, research on self-regulation in other areas of psychology may also provide useful insights into flow metacognitions. For example, Job, Dweck, and Walton (2010) tested in a series of studies the effects of implicit theories about willpower (i.e. self-control ability) on task difficulty (i.e. difficult tasks could be seen

[13] The ACS-90 includes three scales, preoccupation, hesitation, and volatility.

as either energising or draining), ego depletion, and self-regulation. They hypothesised that 'a person's belief about whether willpower is a limited resource' (p. 1686) would affect ego depletion and self-regulation efforts. Building upon the strength model of self-control (Baumeister & Vohs, 2007) that posited that willpower was finite and depleted after exertion, Job et al. (2010) introduced two opposing theories – a limited resource theory and a non-limited resource theory. The limited resource theory was based on the core tenet of the strength model of self-control whereby people believed that self-control was limited and depleted after strenuous activities. The non-limited resource theory proposed the opposite, whereby self-control was perceived to be an unlimited resource. Empirical evidence confirmed that people's beliefs in a non-limited resource theory moderated the effect of task demands on ego depletion. Furthermore, a causal relationship between people's beliefs in their self-regulation capabilities and subsequent task performance was found. Participants who held beliefs congruent with a non-limited resource theory performed significantly better on depleting tasks compared to participants who believed in a limited resource theory. Interestingly, participants in the non-limited resource theory condition were found to perform worse on non-depleting, simple, tasks. Job et al. (2010) speculated that boredom might have had a depleting effect.

It should also be noted that in the context of flow research the simplicity of the task was also found to affect the subsequent quality of the experience. Fullagar, Knight, and Sovern (2013), found that simpler tasks elicited anxiety rather than boredom in a longitudinal study of flow in student musicians (N = 27). Perceived skill level moderated the relationship between task challenges and performance anxiety. Interestingly, musicians with moderate to high levels of skill felt the highest

levels of anxiety when tasks were perceived to be easy; they were also least likely to have experienced flow when anxious. They explained these results in the context of research on the physiological correlates of flow experiences (Dietrich & Stoll, 2010), whereby a simpler task facilitated distracted attention, and made it less likely to experience flow. For less-skilled musicians, the challenge did not appear to affect anxiety, and they experienced flow relatively independently of task challenges and their skills.

7.5 The 'Dark Side' of Flow Metacognitions?[14]

At this stage, the underlying mechanisms of flow metacognitions can only be hypothesised. The FMQ items of the FMQ-2 subscale include people's confidence in getting into, sustaining, and re-entering flow. People scoring highly on FMQ-2 may hold metacognitive beliefs that they can get into flow by altering the characteristics of the activity, e.g. increasing its challenge to match it to one's skills (if the demands of the task had previously been too low) and therefore making the task more flow conducive. For others, confidence in getting into flow may manifest itself by focusing on a limited stimulus field to enable the merging of action and awareness as also discussed previously by Csikszentmihalyi (2000): 'Some people can start a flow episode just by directing their awareness to conform with the requirements of flow, like limiting the stimulus filed so as to allow the merging of action and awareness.' (Csikszentmihalyi, 2000, p. 49). However, one may hypothesise that people who hold flow metacognitions and are confident in their ability to re-enter the state may also be willing to interrupt flow more easily. In contrast, one who feels 'at the mercy' of the task to elicit flow, will be much more reluctant to let go of the state

[14] Partington et al. (2009) had previously discussed 'the dark side of flow' in relation to big wave surfing.

once in it and may also want to hold on to this enjoyable experience for as long as possible, even if this is ultimately maladaptive.

Therefore, the question could be posed whether people's confidence in the ability to self-regulate flow could lead to an adaptive use of flow as well as a maladaptive use (particularly with regard to addictive behaviours). Limited research has focused on the relationships between flow and maladaptive behaviours. Based on identified relationships between flow and personality characteristics, high conscientiousness and low neuroticism were found to be positively related to flow as well as negatively to addictive behaviours. A negative relationship between addiction and flow was also proposed (Ross & Keiser, 2014). As Ross and Keiser (2014) pointed out 'it appears that "flow-ers" – most generally – are notably less likely to engage in addictive behaviour' (Ross & Keiser, 2014, p. 6). A longitudinal study by Wan and Chiou (2006) with Taiwanese online game addicts supported this assumption, as it was shown that flow was negatively related to online addiction tendencies. Yet, as mentioned previously, Partington et al. (2009) argued that an autotelic personality might also be more vulnerable to the addictive properties of flow. A study by Lee, Aiken, and Hung (2012) appeared to lend support to this assumption. They reported positive associations between the time spent playing online games and the frequency of flow experiences during game activities.

A point that was mentioned earlier in the introduction of this dissertation was the analogy by the Greek philosopher Democritus, which Csikszentmihalyi (2002) had quoted: 'Water can be both good and bad, useful and dangerous. To the danger, however, a remedy has been found: learning to swim.' As one could prevent oneself from drowning his suggestion was to 'learn to swim' when it came to flow: 'To swim in this case involves learning to distinguish the useful and the harmful forms of

flow, and then making the most of the former while placing limits on the latter.' (Csikszentmihalyi, 2002, p. 70). This reminds us that flow can both be an optimal state helping humans to flourish as well as a state which can be overly consuming and harmful. Therefore, a word of caution is in order. Having a tool to make 'flow happen' does not mean that one may necessarily use it wisely. However, having gained an understanding of people's beliefs about the self-regulation of flow may take us one step closer to understanding how to make the most of flow as well as how to potentially avoid its harmful consequences.

7.6 Theoretical Implications

Three main theoretical implications follow from this research. First, flow theory was advanced by the identification of a new, important construct that related to people's metacognitions regarding the self-regulation and positive consequences of flow. In particular, flow metacognitions may help to further explain inter-individual differences in the experience of flow. As FMQ-2 predicted both the frequency and intensity of flow, it could therefore be considered an antecedent of flow and an important marker of the autotelic personality. Second, metacognitive theory was advanced by the identification of new, adaptive metacognitions specific to a state of optimal mental experience. It can further be suggested that in demanding situations people may have access to a 'toolbox of adaptive functions', which may help them to adaptively cope with demanding situations. This 'toolbox' may include general adaptive metacognitions (Beer & Moneta, 2010), as well as the more specific adaptive metacognitions of flow and creativity (Kaufman & Beghetto, 2013). Therefore, flow metacognitions, rather than being a stand-alone construct, have been conceptualised and are well placed within the wider theory of metacognitions.

Third, research and theory development in the field of positive psychology were advanced as a new construct was added. Flow metacognitions have their basis within the wider theoretical framework of metacognitive theory and flow theory, and predict optimal human functioning.

7.7 Practical Implications

The findings presented in this study could lead to a range of practical applications, particular in achievement context. Maladaptive metacognitions have been shown to be causally linked to mental health outcomes and were also found to be amenable by interventions, in particular metacognitive therapy (e.g. Fisher & Wells, 2005, Myers & Wells, 2013, Solem, Håland, Vogel, Hansen, & Wells, 2009). Based on these findings, it is assumed that flow metacognitions (in particular as measured by the FMQ-2) may also be modifiable, potentially enabling the enhancement of people's flow experiences. Based on the findings presented in this dissertation, interventions to create or intensify flow should focus on the modification of people's beliefs in the self-regulation of flow, rather than increasing their beliefs in the potentially positive consequences of flow. Furthermore, Fullagar and Kelloway (2013) concluded that flow interventions in the context of work should be aimed at changing the properties of the task that should, in turn facilitate flow. In a similar vein, Csikszentmihalyi (1988), discussing the future of flow, suggested two ways of improving flow experiences: changing the situation and teaching people how to experience flow.

> There are large individual differences in the ability to experience flow. (…) in order to improve the quality of life, two complementary strategies are needed: first, to change social conditions so as to make them more conducive to flow; and second, to educate individuals so that they will be able to experience flow regardless of social conditions. (p. 370–317)

Interestingly, one would assume that once people have been educated to experience flow, changes to the social condition would be superfluous. Tying in with Csikszentmihalyi's (1988) suggestions for the enhancement of flow experiences, educating people about flow metacognitions may be a way to bridge the gap between situational and person variables. People who hold metacognitive beliefs on the self-regulation of flow may be able to restructure their environment flexibly (e.g. such as removing distractions), their perception of the demands, and their skills to adequately cope with these demands or self-regulate their attentional focus on the task. In addition, following on from the work by Job et al. (2010) described earlier, a number of conclusions can be drawn based on their research in relation to flow metacognitions and their practical application for flow in work contexts. Analogous to a non-limited resource theory of willpower, people scoring highly on FMQ-2 may see flow as an unlimited resource, which they can draw upon, create, and sustain relatively at will. However, the opposite may apply to people low in the self-regulation on flow, who may perceive flow as a randomly occurring, limited resource. Furthermore, low task difficulty was found to have a detrimental effect on the quality of the experience for individuals who were more confident in their abilities, both in terms of their actual skills, as reported by Fullagar et al. (2013) in the case of more highly skilled musicians, and in their beliefs in their willpower as reported by Job et al. (2010). It would therefore be important to understand the potential moderating role of task demands on the relationship between flow metacognitions and flow in an achievement context such as work. Two opposing views appear to be feasible. It could be speculated that people who are very skilled in the self-regulation of flow experiences, but have been given relatively easy work tasks (i.e. tasks of low demands), may experience non-optimal states such as anxiety

or boredom. However, people who do not have the capacity to self-regulate flow, may still get into flow 'randomly' during tasks of low difficulty, as was found to be the case for lesser skilled musicians whose flow levels were relatively independent of task difficulty (Fullagar et al., 2013). Yet, it could also be argued that people who score highly on their confidence in self-regulating flow can still make flow happen even when the properties of the task, such as low task demands, are not flow conducive. These relationships would need to be tested empirically.

Furthermore, Job et al. (2010) reported to have successfully manipulated people's beliefs about willpower experimentally via a 'biased questionnaire' that was designed to foster agreement with either a non-limited resource theory (e.g. 'Sometimes working on a strenuous mental task can make you feel energized for further challenging activities') or a limited-resource theory (e.g. 'Working on a strenuous mental task can make you feel tired such that you need a break before accomplishing a new task') of willpower (p. 1688). Although metacognitions, including FMQ-2, were found to be relatively stable, metacognitions in the clinical context were also reported to be amenable to intervention. Therefore, it may also be conceivable that people's confidence in terms of the self-regulation of flow could be changed. An experimental manipulation, similar to the one used by Job et al. (2010), could provide initial evidence for possible treatment effects.

7.8 Study Limitations

Limitations with regard to the individual research studies were outlined in each of the chapters. However, it is also important to point out the main limitations of this PhD research.

First, this research identified two main flow metacognitions. However, due to the scope of this research, it does not claim that it captured all metacognitions related to the flow state. Therefore, other flow relevant metacognitions may have remained unidentified. Second, this research measured flow as a disposition in the context of work. However, the underlying processes whereby flow metacognitions impact on the experience of flow need to be understood further. This can be done by the measurement of moment-to-moment variations in state flow, based on longitudinal ESM or end-of-day diary methodologies in order to understand the temporal order of the impact of flow metacognitions. In particular, it is important to understand whether flow metacognitions affect flow directly or indirectly, via the antecedents of flow (in terms of the challenge–skills balance, immediacy of feedback, and clarity of goals). Third, this research has provided initial empirical evidence for a link between adaptive metacognitions, flow, and flow metacognitions. However, this has been only the first step and further research is necessary to understand the processes by which both adaptive as well as flow metacognitions facilitate the experience of flow more fully.

7.9 Outlook on Future Research

Despite its limitations, this research has opened up a range of possible avenues for further study, both to address the aforementioned limitations and to understand the mechanisms by which flow metacognitions operate more fully. It is suggested that future research focus on the following areas: The underlying processes of flow metacognitions need to be understood better. Future studies should focus on the assessment of flow as a state based on ESM or end-of-day diary methods and should assess any changes in people's flow metacognitions, with regard to state flow and the activity context. In addition, the link between flow, adaptive metacognitions, and

flow metacognitions needs to be further investigated. In particular, it is important to understand if a sequence of adaptive metacognitive efforts could lead to the activation of flow metacognitions. Furthermore, the potential existence of additional metacognitions specific to the experience of flow should be investigated. Engeser and Schiepe-Tiska (2012) pointed out, that 'like sleeping and waking, flow experience has to be accompanied by relaxation (…). Therefore, the optimal balance between flow experiences and other states of consciousness might come under closer examination (…). We suggest that persons may need to alternate and trade off flow with other experiences in order to optimize their lives.' (p. 7). However, this poses the question, 'how would people know if and when they needed to switch from flow to other states?'. One would assume that certain beliefs on the flow state would be necessary, i.e. the knowledge that under certain circumstances flow is 'good', whereas in other circumstances flow is unnecessary, and energy resources can be preserved, or flow may even be detrimental. Potential flow metacognitions, such as people's confidence in switching flexibly between different optimal experiences, including states of rest and relaxation, should be investigated further.

7.10 Concluding Remarks

In summary, this PhD research has fulfilled its aims of identifying metacognitions about the flow experience as well as establishing a causal link between metacognitions and flow. In addition, it has provided important insights towards an understanding of the self-regulation of optimal experience in general.

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Appendixes

Appendix 1: Consent Forms and Debriefing Sheets

PARTICIPANT INFORMATION SHEET

Dear Participant

You are being invited to take part in a research project. Before you decide to participate it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask if anything is unclear or if you would like more information.

This project aims to understand how people achieve and maintain optimal experiences at work. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a consent form.

The researcher will go through a number of questions regarding experiences of enjoyment and deep concentration with you, e.g. when do you have this experience at work, how does it get started and what keeps it going. This will take approximately 30-45 minutes of your time. This study is a one-off and will not be repeated with the same participants at a later stage. Given your prior consent, the interview will be recorded on a tape recorder or, alternatively, written notes may be taken. The anonymised interviews will subsequently be transcribed and analysed. The final report will only report aggregated findings and individuals will not be identifiable in any way.

This study is exploratory in nature and you are only required to describe your personal experience. There are therefore no right or wrong answers.

If you decide to participate in this study, your participation and any information collected from you will be strictly confidential, and only available to the research team.

We would like to thank you, in advance, for your participation.

Supervisor: Dr Giovanni Moneta

Researcher: Edith Wilson

PARTICIPANT CONSENT FORM

London Metropolitan University, School of Psychology

CONSENT STATEMENT

1. I understand that my participation is voluntary and that I may withdraw from the research at any time, without giving any reason.

2. I am aware of what my participation will involve.

3. I understand that there are no risks involved in the participation of this study.

4. I provide my demographic details (gender, age etc.) in the understanding that any identifying information will be separated from the data, so my anonymity will be maintained.

5. I understand that the anonymised data I provide may be used in publications and/or conferences.

6. All questions that I have about the research have been satisfactorily answered.

I agree to participate.

Participant's signature: _____

Participant's name (please print): _____

Tick this box if you would like to receive a summary of the results by e-mail ☐

E-mail: _____

Date: _____

PARTICIPANT DEBRIEFING SHEET

London Metropolitan University, School of Psychology

Thank you for your participation in this project.

The aim of this study is to understand how people achieve and maintain optimal experiences at work. These optimal experiences have also been described in the academic literature as 'flow'. People who are 'in flow' tend to be totally absorbed in the activity they are doing (sometimes they forget to eat or don't even notice when the phone rings) and they also find the activity very enjoyable.

The interview asked specifically about flow experiences at work with the purpose of finding out if people (1) have these experiences at work, (2) can describe how they achieve and maintain flow at work, and also (3) hold certain beliefs about having flow (for example beliefs about the usefulness of flow at work).

Awareness and beliefs about cognitive functioning and processes are also known as 'metacognitions'. As described by Brown (1987) metacognition comprises both knowledge about one's cognition and the regulation of cognitive processes. In addition, this project seeks to identify the 'metacognition of flow', i.e. awareness, beliefs and regulation of flow experiences, via the questions asked during the interview.

It is hypothesised that most people will be able to recognise and describe flow experiences at work. However, to date the metacognition of flow has not been researched but it is assumed that people can reflect on their flow experiences (i.e. show an awareness), hold (perhaps positive or negative) beliefs about the usefulness of flow during work and have strategies to regulate flow.

It is important to stress that there are no right or wrong answers during the interview. A lot of people don't experience flow at work for a number of reasons and those accounts are equally valid for this research. Your support for this project will contribute to the growing knowledge of flow and metacognition in particular and the area of Positive Psychology (a relatively new field of psychology which studies the positive aspects of human life) in general.

If you later decide that you no longer want your responses to be part of this study, and you don't need to give any reason, please contact the lead researchers (see details below) and your data will be removed from the analysis. All data collected in this study will be aggregated and the analysis will not identify any individuals. All answers will therefore be anonymous.

For more general information on flow and positive psychology, you might be interested in reading:

Csikszentmihalyi, M (1990). *Flow: The psychology of optimal experience.* New York: Harper & Row.

Linley P. & Joseph S. (2004). *Positive Psychology in Practice.* New Jersey: Wiley & Sons.

Thank you again for participating in this study. If you would like more information, or have any further questions about any aspect of this study, then please feel free to contact

Dr Giovanni Moneta (g.moneta@londonmet.ac.uk) or Edith Wilson (eem012@my.londonmet.ac.uk)

School of Psychology, London Metropolitan University

PARTICIPANT INFORMATION

Dear participant,

You are being invited to take part in a study which is being conducted as part of a PhD research project at the School of Psychology, London Metropolitan University. Please take time to read the following information before you decide to participate. Ask or contact the researcher (by email – see details below) if anything is unclear or if you would like more information and a copy of this information sheet.

This project aims to understand how people achieve and maintain optimal experiences at work and study. It also aims to assess if these experiences change over time.

Your participation in this study requires you to fill out a survey, this survey. This survey comprises a questionnaire which will take **approximately 20 minutes** of your time. On page 1 you will be asked demographic questions (such as your age and type of employment) which will be used to perform statistical comparisons between groups with different backgrounds. On pages 2-4 you will be asked questions on your experience when engaging in work or leisure activities. On pages 5-9 you will be asked to complete questionnaires used to identify personal preferences in work contexts and approaches people adopt in challenging endeavours.

[*For longitudinal study:* You will be contacted via email and asked to complete a follow-up questionnaire in approximately 1-2 months to assess possible changes in optimal experiences over time. You will also be asked to generate a password based on the first and last letter of your father's first name and the name of your first school so that your responses to both surveys can be linked in an anonymised way.]

If you decide to participate in this study, your participation and any information collected from you will be strictly confidential, and only available to the research team. Only anonymised data will be analysed and the results from this study may be published or presented at conferences but these will not identify individuals in any way. Your participation is voluntary and you may withdraw from the research at any time, without giving any reason.

We would like to thank you in advance for your participation.

Supervisor: Dr Giovanni Moneta, London Metropolitan University
Researcher: Edith Wilson, PhD student, London Metropolitan University,
(eem012@my.londonmet.ac.uk)

PARTICIPANT'S CONSENT

- I have been informed of and understand the purpose of this study and its procedures and wish to participate.
- I also understand that I can contact the researcher via email (Edith Wilson, eem012@my.londonmet.ac.uk) at the end of my participation, who will be happy to send me a debrief information sheet and I will have a further opportunity to ask any questions about this study.
- I understand that the data collected for this study is strictly confidential and I will not be identifiable in any report of this study. I further understand that the anonymised data I provide may be used in publications and/or conferences.
- I understand my right not to participate in this study without being penalised or disadvantaged in any way. I further understand that I may decide to withdraw from this study at any time without prejudice to me.
- [*for longitudinal study:* I consent to being contacted for the follow-up study in approximately 1-2 months. I understand my right not to participate in the follow-up study without giving reason.]

By selecting the option 'Yes, I accept' in the following dropdown menu I confirm that I have read and understood the information specified above, and that I wish to participate in this study:

(Click to select)

RESEARCHER'S STATEMENT

I have informed the participant of the nature and purpose of this study and have sought to answer any questions to the best of my ability. I have read, understood, and agree to abide by the Ethical Principles for Conducting Research with Human Participants set out by the British Psychological Society in carrying out this study.

Print name: Edith Wilson

PARTICIPANT DEBRIEFING SHEET

London Metropolitan University, School of Psychology

Thank you for your participation in this project.

The aim of this study is to understand how people can perform their best at work or study. Some people have described that they perform their best when they are 'in flow'. People who are 'in flow' tend to be totally absorbed in the activity they are doing. Sometimes they forget to eat or don't even notice when the phone rings. They also find the activity very enjoyable.

The questionnaire asked specifically about flow experiences to find out if people:

(1) have these experiences at work/study;

(2) can describe how they achieve and maintain flow at work/study;

(3) hold certain beliefs about having flow.

In addition, this project seeks to identify the way people 'think about flow'.

To date the way people reflect on flow experiences has not been researched. Preliminary questions, designed to measure how people 'think about' flow, were added to the questionnaire. The aim is to see how people's views about their flow experience relate to other areas, e.g. how we engage with work, how we feel during certain situations, and how we handle difficult situations. The follow up study will also measure if these views change over time.

There are no right or wrong answers. It also does not matter if you do not experience flow as about a third of people never experience flow. All data collected for this study will be aggregated and the analysis will not identify any individuals. All answers will be anonymous.

Thank you again for participating in this study. Your support for this project will contribute to the growing knowledge about flow experiences and the wider area of Positive Psychology. Positive Psychology is a relatively new field of psychology which studies the positive aspects of human life. If you are looking for further information on flow or Positive Psychology you might find the following books interesting:

Csikszentmihalyi, M (1990). *Flow: The psychology of optimal experience.* New York: Harper & Row.

Linley P. & Joseph S. (2004). *Positive Psychology in Practice.* New Jersey: Wiley & Sons.

Please feel free to contact the researchers if you have further questions.

Edith Wilson (eem012@my.londonmet.ac.uk)

Dr Giovanni Moneta (g.moneta@londonmet.ac.uk)

School of Psychology, London Metropolitan University

Appendix 2: Semi-Structured Interview Guide

Please read the following quotes and reflect if you have ever had similar experiences at work. If so, please describe the context and the activity you were engaged in.

> 'My mind isn't wandering. I am totally involved in what I am doing and I am not thinking of anything else. My body feels good…the world seems to be cut off from me…I am less aware of myself and my problems. '
>
> 'My concentration is like breathing … I never think of it … When I start, I really do shut out the world.'
>
> 'I am so involved in what I am doing … I don't see myself as separate from what I am doing.'
>
> 'Once I stop I can let it back again.'
>
> 'I am really quite oblivious to my surroundings after I really get going in this activity.'
>
> 'I think that the phone could ring, and the doorbell could ring or the house burn down or something like that …'

If interviewee is aware of flow during work activities:

1. How does it [flow] feel getting started? What do you do to get it [flow] started? Can it [flow] happen anywhere anytime?

2. Getting into the flow: When does it happen during the activity?

3. When you are in flow, how does it feel?

4. What keeps it going once it [flow] starts?

5. How do you get back into the state [flow] if it is interrupted?

6. When does this experience finish (e.g. when the job is done or before)?

7. What is positive about this state? What I negative about this state?

8. Do you have any strategies to get into this state/ to stay in this state/ to end this state?

9. What does being in flow during this activity mean for the quality of your work?

Appendix 3: Flow Questionnaire and FMQ Pilot Questionnaire

This questionnaire investigates the knowledge and beliefs people hold about optimal experiences during work or study – e.g. when you become very engrossed in a task and shut out external distractions. The following quotes detail how some people have described these optimal experiences:

'My mind isn't wandering. I am totally involved in what I am doing and I am not thinking of anything else. My body feels good … the world seems to be cut off from me … I am less aware of myself and my problems.'

'My concentration is like breathing … I never think of it … When I start, I really do shut out the world.'

'I am so involved in what I am doing … I don't see myself as separate from what I am doing.'

1. Have you ever felt similar experiences during work or study?

YES ☐ NO ☐ (go to **2**)

If **YES**, what specific activity were you doing while working/studying when you had such experiences? *(please specify)*

Activity:	go to **3** (FMQ pilot Questionnaire)

2. **If NO:** Have you ever felt similar experiences during leisure?

YES ☐ NO ☐ (go to end of questionnaire)

If YES, what specific activity were you engaged in when you had such experiences? *(please specify)*

Activity:	go to **3** (FMQ pilot Questionnaire)

FMQ Pilot Questionnaire (continued on next pages)

Please read each item and try to imagine yourself while you were doing the above activity and the experiences you have had during this activity. If you have had this experience during work/study – think only of the work/study activity you specified, if you do not have this experience at work/study think of the leisure activity you specified. Please circle one response which appears to be the most appropriate one for you while carrying out this activity.

1 Do not agree 2 Agree slightly 3 Agree moderately 4 Agree very much

1. The activity has to be challenging otherwise I will not experience flow.	**1**	**2**	**3**	**4**
2. I get into flow once I have overcome an initial phase of 'wandering attention'.	**1**	**2**	**3**	**4**
3. I am more creative when I am in flow.	**1**	**2**	**3**	**4**
4. When I have flow, it feels as if my brain has fully 'warmed up'.	**1**	**2**	**3**	**4**
5. Flow starts almost immediately after beginning the activity.	**1**	**2**	**3**	**4**
6. It takes sustained effort to get flow started.	**1**	**2**	**3**	**4**
7. I try not to let my mind wander in order to keep flow going.	**1**	**2**	**3**	**4**
8. There is nothing I do in particular to get flow started.	**1**	**2**	**3**	**4**
9. I feel confident and in control of what I am doing when I am in flow.	**1**	**2**	**3**	**4**
10. When I have flow my thinking happens in a way where it is possible to make connections easily.	**1**	**2**	**3**	**4**
11. I try to keep my mind 'fresh' in whatever way I can when I am in flow.	**1**	**2**	**3**	**4**
12. When I have flow I tend to get a lot done.	**1**	**2**	**3**	**4**
13. In order to have flow, I ignore interruptions from others.	**1**	**2**	**3**	**4**
14. I am able to quickly re-enter flow if I need to.	**1**	**2**	**3**	**4**
15. It is in my power to control when I have flow.	**1**	**2**	**3**	**4**
16. I don't do anything 'consciously' to maintain flow during the activity.	**1**	**2**	**3**	**4**
17. I become completely focused on the task when I am in flow.	**1**	**2**	**3**	**4**
18. When I am in flow, I 'tune out' to what is around me.	**1**	**2**	**3**	**4**
19. Flow is more likely to happen when I am on my own.	**1**	**2**	**3**	**4**
20. It is easy for me to generate ideas once I have flow.	**1**	**2**	**3**	**4**
21. Flow usually happens when I've organised myself and my surroundings.	**1**	**2**	**3**	**4**
22. When I have this experience, I do not switch off until I have achieved what I set out to do.	**1**	**2**	**3**	**4**
23. It usually takes a little while before I get flow.	**1**	**2**	**3**	**4**
24. I tend to have my 'breakthroughs' when I am in flow.	**1**	**2**	**3**	**4**

25. Flow seems to come up without me noticing such.	**1**	**2**	**3**	**4**
26. Flow has a positive effect on the activity.	**1**	**2**	**3**	**4**
27. Without being in flow I feel that I am not fully processing information.	**1**	**2**	**3**	**4**
28. My thinking becomes clearer when I am in flow.	**1**	**2**	**3**	**4**
29. I can make an activity more challenging in order to have flow.	**1**	**2**	**3**	**4**
30. When I am in flow I end up spending a lot of time without actually achieving much.	**1**	**2**	**3**	**4**
31. In order to have this experience I make a boring activity more interesting.	**1**	**2**	**3**	**4**
32. I have ways of shutting myself off and maintaining flow when I am in a noisy environment.	**1**	**2**	**3**	**4**
33. I am able to sustain flow for long periods.	**1**	**2**	**3**	**4**
34. I know that by being in flow I achieve more.	**1**	**2**	**3**	**4**
35. I am not losing focus when I am in flow.	**1**	**2**	**3**	**4**
36. I am able to generate various ideas and options while being in flow.	**1**	**2**	**3**	**4**
37. I get side-tracked from what I have set out to do when I am in flow.	**1**	**2**	**3**	**4**
38. I am aware of the conditions that lead to flow.	**1**	**2**	**3**	**4**
39. I know that I have to look for a challenge to have flow.	**1**	**2**	**3**	**4**
40. I know how I can re-create having flow if I want to.	**1**	**2**	**3**	**4**
41. I can get into flow by setting myself goals.	**1**	**2**	**3**	**4**
42. I find that I make more progress when I have flow.	**1**	**2**	**3**	**4**
43. When I need to get the job done, I rely on my ability to have this flow.	**1**	**2**	**3**	**4**
44. When I come across a task which I don't particularly enjoy, I just make it more enjoyable in order to have flow.	**1**	**2**	**3**	**4**
45. A noisy environment does not affect me having flow.	**1**	**2**	**3**	**4**
46. There is no way of telling when I will have flow.	**1**	**2**	**3**	**4**
47. I know what I need to do to get into flow.	**1**	**2**	**3**	**4**
48. If the circumstances are not right there is nothing I can do to bring about flow.	**1**	**2**	**3**	**4**
49. I have flow when I've made a task more difficult.	**1**	**2**	**3**	**4**
50. I prefer tasks where I can have flow.	**1**	**2**	**3**	**4**
51. Once I start with the activity there is no stopping me getting into flow.	**1**	**2**	**3**	**4**
52. I find it helpful to listen to music in order to get into flow.	**1**	**2**	**3**	**4**
53. Finishing an activity during which I have had flow feels rewarding.	**1**	**2**	**3**	**4**

Appendix 4: Exploratory Factor Analysis on Pilot FMQ (53 items) – Four-Factor Solution

Exploratory factor analysis, forcing a four-factor solution, was re-run on the pilot FMQ, as parallel analysis had indicated a potential four-factor solution. Principal component analysis via direct oblimin oblique rotation was applied. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was .8 (above the cut-off value of .6) and Bartlett's Test of Sphericity (*Approximate* $\chi^2 = 4261.5$, $p<.001$) was significant, indicating good factorability of the data and confirming that principal component analysis was appropriate to use on the data (Bartlett, 1954). The total variance explained by all four components was 37.3% (Component 1 = 17.1%, Component 2 = 10.4%, Component 3 = 5.3%, and Component 4 = 4.5%). Item intercorrelations were low ($r_{12} = .11$, $r_{13} = .11$, $r_{14} = .04$, $r_{23} = .05$, $r_{24} = .11$, and $r_{34} = .03$). Table 13 shows the pattern matrix for the four-factor solution of the 53-item pilot.

Component 1 captured the usefulness of being in flow – i.e. a belief that flow enabled achievement – and Component 2 included items on people's beliefs in the self-regulation of flow and an awareness of the conditions under which flow occurs. Components 3 and 4 comprised a small number of items and their percentages variance explained were relatively low. Component 3 appeared to tap into flow as an effortful experience, with three items loading above .5 (i.e., 'It takes sustained effort to get flow started', 'It usually takes a little while before I get flow', and 'I try not to let my mind wander in order to keep flow going').

Component 4 comprised only two items with loadings of .5 and above. This component appeared to capture flow as an experience driven by the context rather than the individual ('There is no way of telling when I will have flow' and 'I find it helpful to listen to music in order to get into flow'). An additional three items had

loadings of .4 and above, and included ‘If the circumstances are not right there is nothing I can do to bring about flow’, ‘There is nothing I do in particular to get flow started’, and ‘Flow seems to come up without me noticing such’.

Overall, the analysis showed that Component 1 and Component 2 are the main components of metacognitions of flow, with the majority of items loading onto these two components. Component 1 and Component 2 also contributed the highest percentages of variance explained. Only a relatively limited number of items loaded substantially onto Component 3 and Component 4 and the component’s variances explained were relatively small. Therefore, these components were not retained for further analysis. However, this research does not claim to have fully captured all relevant metacognitions of flow and future research may want to investigate these components further for their validity.

Table 13: Pattern matrix for the 53-item pilot questionnaire (four-factor solution; direct oblimin rotation, N = 204) (continued on next pages)

Questionnaire item	Comp 1	Comp 2	Comp 3	Comp 4
17. I become completely focused on the task when I am in flow.	**0.75**	-0.05	-0.07	-0.02
26. Flow has a positive effect on the activity.	**0.71**	-0.05	-0.01	-0.04
20. It is easy for me to generate ideas once I have flow.	**0.69**	-0.01	-0.09	0.01
36. I am able to generate various ideas and options while being in flow.	**0.69**	0.06	-0.09	-0.05
28. My thinking becomes clearer when I am in flow.	**0.67**	-0.03	0.07	-0.02
12. When I have flow I tend to get a lot done.	**0.64**	0.07	0.12	-0.06
3. I am more creative when I am in flow.	**0.63**	0.04	-0.10	0.21
34. I know that by being in flow I achieve more.	**0.63**	0.08	0.27	-0.03
53. Finishing an activity during which I have had flow feels rewarding.	**0.62**	0.08	0.05	-0.08
42. I find that I make more progress when I have flow.	**0.61**	0.10	0.24	-0.16
35. I am not losing focus when I am in this state.	**0.60**	0.01	0.07	-0.07

Questionnaire item	Comp 1	Comp 2	Comp 3	Comp 4
4. When I have flow, it feels as if my brain has fully 'warmed up'.	**0.59**	-0.06	-0.04	0.05
18. When I am in flow, I 'tune out' to what is around me.	**0.58**	-0.12	-0.11	0.03
10. When I have flow my thinking happens in a way where it is possible to make connections easily.	**0.57**	0.11	-0.15	0.11
19. Flow is more likely to happen when I am on my own.	**0.55**	-0.04	0.16	-0.03
9. I feel confident and in control of what I am doing when I am in flow.	**0.52**	0.15	-0.14	-0.03
24. I tend to have my 'breakthroughs' when I am in flow.	0.49	-0.05	0.33	0.20
50. I prefer tasks where I can have flow.	0.43	-0.01	0.06	0.23
30. When I am in flow I end up spending a lot of time without actually achieving much.	-0.42	0.24	0.10	0.35
1. The activity has to be challenging otherwise I will not experience flow.	0.40	0.24	0.01	-0.01
21. Flow usually happens when I've organised myself and my surroundings.	0.39	0.16	0.32	-0.10
13. In order to have flow, I ignore interruptions from others.	0.38	0.24	0.21	0.07
2. I get into flow once I have overcome an initial phase of 'wandering attention'.	0.37	-0.13	0.36	-0.08
40. I know how I can re-create having flow if I want to.	-0.01	**0.73**	-0.13	-0.10
14. I am able to quickly re-enter flow if I need to.	-0.04	**0.66**	-0.22	0.01
47. I know what I need to do to get into flow.	-0.09	**0.65**	-0.11	-0.21
15. It is in my power to control when I have flow.	0.05	**0.65**	-0.06	-0.14
51. Once I start with the activity there is no stopping me getting into flow.	-0.15	**0.62**	-0.06	0.24
44. When I come across a task which I don't particularly enjoy, I just make it more enjoyable in order to have flow.	-0.22	**0.60**	0.17	0.21
29. I can make an activity more challenging in order to have flow.	0.04	**0.59**	0.06	0.16
41. I can get into flow by setting myself goals.	0.07	**0.57**	0.19	-0.15
33. I am able to sustain flow for long periods.	0.15	**0.55**	-0.21	0.07
38. I am aware of the conditions that lead to this experience.	0.03	**0.51**	-0.03	-0.21
39. I know that I have to look for a challenge to have flow.	0.04	0.49	0.18	0.23
31. In order to have this experience I make a boring activity more interesting.	-0.05	0.43	0.38	0.28
22. When I have this experience, I do not switch off until I have achieved what I set out to do.	0.24	0.43	0.11	-0.01
43. When I need to get the job done, I rely on my ability to have this flow.	0.17	0.42	0.33	-0.11
49. I have flow when I've made a task more difficult.	-0.16	0.41	0.11	0.41

Questionnaire item	Comp 1	Comp 2	Comp 3	Comp 4
11. I try to keep my mind 'fresh' in whatever way I can when I am in flow.	0.23	0.40	0.23	0.04
5. Flow starts almost immediately after beginning the activity.	0.03	0.40	-0.38	0.02
32. I have ways of shutting myself off and maintaining flow when I am in a noisy environment.	0.12	0.36	-0.06	0.09
6. It takes sustained effort to get flow started.	-0.04	-0.20	**0.67**	0.11
23. It usually takes a little while before I get flow.	0.20	-0.15	**0.55**	0.12
7. I try not to let my mind wander in order to keep flow going.	0.10	0.16	**0.52**	0.03
16. I don't do anything 'consciously' to maintain flow during the activity.	0.30	0.01	-0.49	0.31
27. Without being in flow I feel that I am not fully processing information.	0.25	0.04	0.28	0.27
46. There is no way of telling when I will have flow.	0.00	-0.27	0.15	**0.58**
52. I find it helpful to listen to music in order to get into flow.	-0.07	0.12	0.01	**0.53**
48. If the circumstances are not right there is nothing I can do to bring about flow.	0.02	-0.09	0.10	0.47
8. There is nothing I do in particular to get flow started.	0.12	-0.15	-0.32	0.45
25. Flow seems to come up without me noticing such.	0.40	-0.04	-0.22	0.43
45. A noisy environment does not affect me having flow.	0.01	0.16	-0.21	0.35
37. I get side-tracked from what I have set out to do when I am in flow.	-0.22	0.12	0.16	0.32

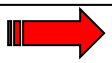
Notes. For illustrative purposes items included in the final version of the FMQ were highlighted in grey. Factor loadings of .5 or above are in bold.

Appendix 5: FQ Preamble (Flow Quotes and Flow Activity Selection), FMQ (Final 12-Item Measure)

Please read the following quotes:

> 'My mind isn't wandering. I am totally involved in what I am doing and I am not thinking of anything else. My body feels good... the world seems to be cut off from me ... I am less aware of myself and my problems.'
>
> 'My concentration is like breathing ... I never think of it ... When I start, I really do shut out the world.'
>
> 'I am so involved in what I am doing ... I don't see myself as separate from what I am doing.'

Have you ever felt similar experiences? Yes NO

If **no**, please go to **page x**: 

If **yes**, please answer the following questions:

Henceforth, we will call the experience described in the three above quotations 'flow'.

How often did you have flow in the past twelve months? Click to select

What activities were you engaged in when you had flow? Please write them down in the text fields on the left, and specify whether each listed activity is either work or leisure using the dropdown menus on the right:

Activity	Is this activity work or leisure?
Activity No. 1:	Click to select
Activity No. 2:	Click to select
Activity No. 3:	Click to select
Activity No. 4:	Click to select
Activity No. 5:	Click to select

Please write below the name of the activity – among those you quoted – which **best represents** the experience described in the three quotations, i.e. the activity where

you have flow with the highest intensity**. If you have flow during work**, write below the **work activity** where you have flow with the highest intensity. If you do **not** have flow during work, write below the **leisure activity** where you have flow with the highest intensity.

[ ] ('SELECTED ACTIVITY')

How often did you have flow while you were doing the SELECTED ACTIVITY in the past twelve months? [Click to select]

While you were carrying out the SELECTED ACTIVITY, for what **percentage of times** did you have flow? [Click to select]

While you were carrying out the SELECTED ACTIVITY and you had flow, **how long** did flow last on average? [ ] min

Flow Metacognitions Questionnaire (FMQ)

Please read each item and try to imagine yourself while you were doing the **selected activity** and the experience you have had during this activity. If you have had this experience during work/study – think only of the work/study activity you specified, if you do not have this experience at work/study think of the leisure activity you specified. Please circle one response per question which appears to be the most appropriate one for you while carrying out this activity.

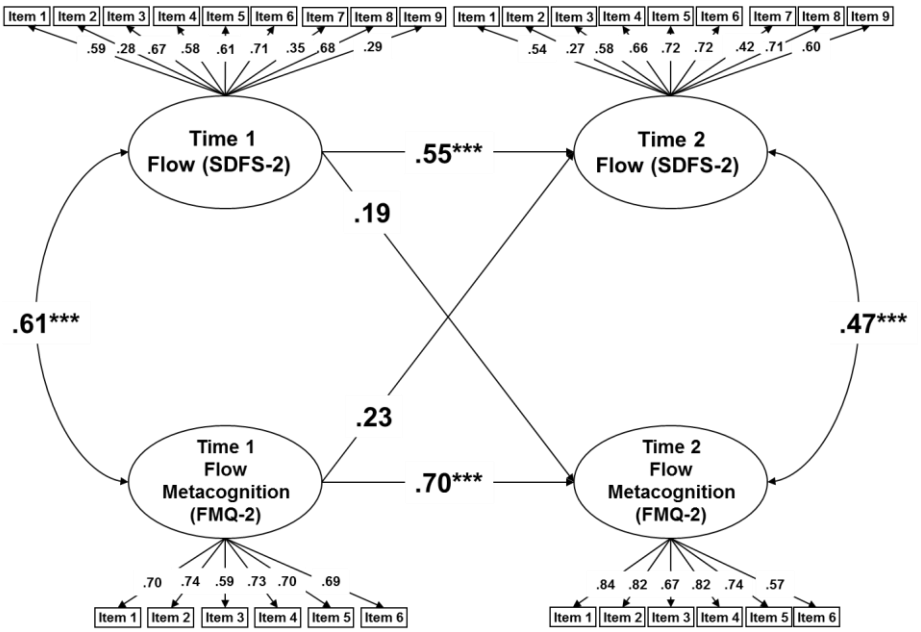
1 Do not agree 2 Agree slightly 3 Agree moderately 4 Agree very much

1	I become completely focused on the task when I am in flow.	1	2	3	4
2	I know how I can re-create having flow if I want to.	1	2	3	4
3	Flow has a positive effect on the activity.	1	2	3	4
4	I am able to quickly re-enter flow if I need to.	1	2	3	4
5	I am able to generate various ideas and options while being in flow.	1	2	3	4
6	Once I start with the activity there is no stopping me getting into flow.	1	2	3	4
7	I know that by being in flow I achieve more.	1	2	3	4
8	I know what I need to do to get into flow.	1	2	3	4
9	My thinking becomes clearer when I am in flow.	1	2	3	4
10	It is in my power to control when I have flow.	1	2	3	4
11	I am more creative when I am in flow.	1	2	3	4
12	I am able to sustain flow for long periods.	1	2	3	4

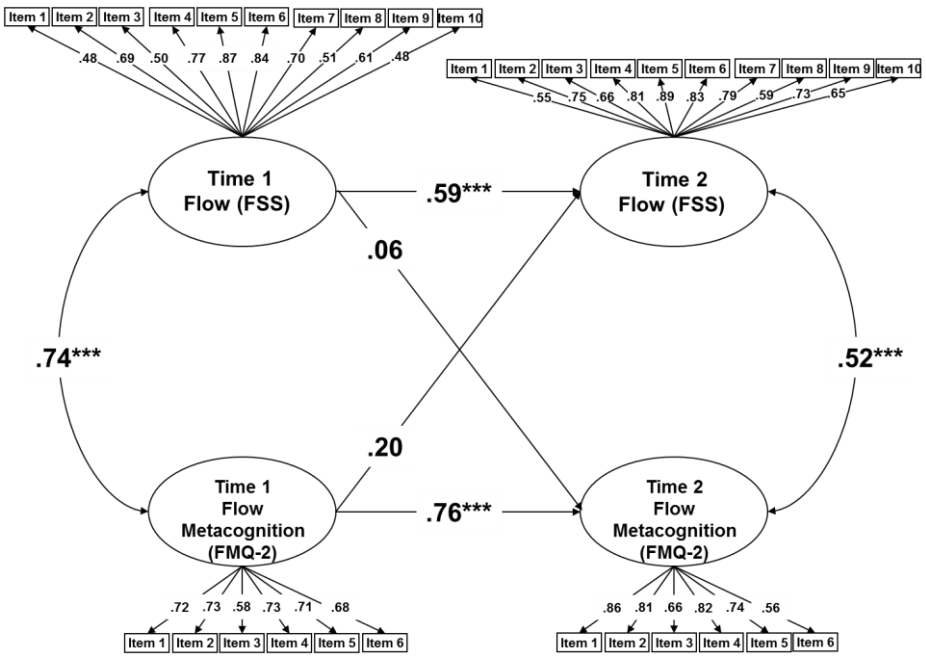
Appendix 6: Estimated Reciprocal Models for FMQ-2 and Flow

The reciprocal models (Model 4) for Confidence in Ability to Self-Regulate Flow (FMQ-2) and flow at work are presented in Figure 7. The goodness-of-fit indices are presented in Table 12. For the SDFS-2, the reciprocal model (Model 4) outperformed the reversed causality model (Delta $\chi^2(1) = 4.56$, $p = 0.033$) but did not outperform the causality model (Delta $\chi^2(1) = 2.24$, $p = 0.13$). When flow was measured by the FSS, the reciprocal model (Model 4) outperformed the reversed causality model (Delta $\chi^2(1) = 4.87$, $p = 0.027$), but did not outperform the causality model (Delta $\chi^2(1) = .00$, $p = 1.00$). For the SFWS, the reciprocal model (Model 4) outperformed the reversed causality model (Delta $\chi^2(1) = 12.32$, $p = 0.00045$) but did not outperform the causality model (Delta $\chi^2(1) = .00$, $p = 1.00$). Overall, the analyses suggested that the causality model was the best fitting and most parsimonious model.

(a) SDFS-2


Item 1 Item 2 Item 3 Item 4 Item 5 Item 6 Item 7 Item 8 Item 9
.59 .28 .67 .58 .61 .71 .35 .68 .29
Item 1 Item 2 Item 3 Item 4 Item 5 Item 6 Item 7 Item 8 Item 9
.54 .27 .58 .66 .72 .72 .42 .71 .60
Time 1 Flow (SDFS-2)
Time 2 Flow (SDFS-2)
.55***
.19
.61***
.47***
.23
Time 1 Flow Metacognition (FMQ-2)
Time 2 Flow Metacognition (FMQ-2)
.70***
.70 .74 .59 .73 .70 .69
.84 .82 .67 .82 .74 .57
Item 1 Item 2 Item 3 Item 4 Item 5 Item 6
Item 1 Item 2 Item 3 Item 4 Item 5 Item 6

(b) FSS


Item 1 Item 2 Item 3 Item 4 Item 5 Item 6 Item 7 Item 8 Item 9 Item 10
.48 .69 .50 .77 .87 .84 .70 .51 .61 .48
Item 1 Item 2 Item 3 Item 4 Item 5 Item 6 Item 7 Item 8 Item 9 Item 10
.55 .75 .66 .81 .89 .83 .79 .59 .73 .65
Time 1 Flow (FSS)
Time 2 Flow (FSS)
.59***
.06
.74***
.52***
.20
Time 1 Flow Metacognition (FMQ-2)
Time 2 Flow Metacognition (FMQ-2)
.76***
.72 .73 .58 .73 .71 .68
.86 .81 .66 .82 .74 .56
Item 1 Item 2 Item 3 Item 4 Item 5 Item 6
Item 1 Item 2 Item 3 Item 4 Item 5 Item 6

(c) SFWS

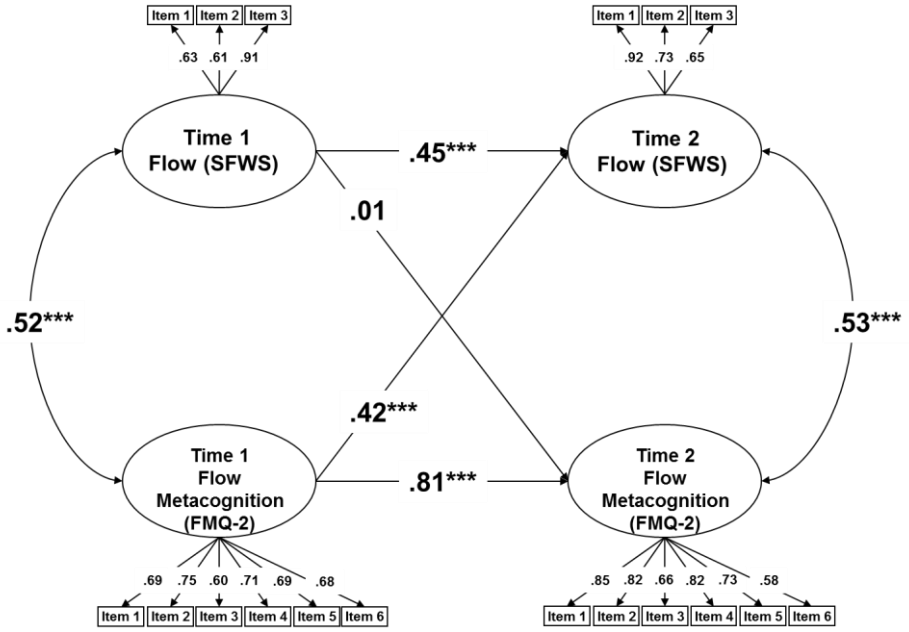


Figure 7: [15] Estimated reciprocal models, with standardised path coefficients and factor loadings of the latent variables, for FMQ-2 and flow measured by (a) the SDFS-2, (b) the FSS, and (c) the SFWS

[15] Two-tailed and one-tailed p-values were computed in SPSS using the cumulative distribution function with the t-distribution being approximated by the standard normal distribution. The asterisks in Figure 7 present the two-tailed significance levels and one-tailed levels are presented below.

For Figure 7 (a) SDFS-2: Stability path from 'Time 1 Flow' to 'Time 2 Flow': $z = 3.51$, $p < 0.001$; stability path from 'Time 1 Flow Metacognition' to 'Time 2 Flow Metacognition': $z = 5.74$, $p < 0.001$ (one-tailed); causal path: $z = 1.83$, $p = 0.035$. The causal path is significant. Reversed causal path: $z = 1.82$, $p = 0.036$. The reversed causal path is significant.

For Figure 7 (b) FSS: Stability path from 'Time 1 Flow' to 'Time 2 Flow': $z = 3.63$, $p < 0.001$; stability path from 'Time 1 Flow Metacognition' to 'Time 2 Flow Metacognition': $z = 5.26$, $p < 0.001$; causal path: $z = 1.55$, $p = 0.062$. The causal path approaches significance. Reversed causal path: $z = .53$, $p = 0.300$. The reversed causal path is not significant.

For Figure 7 (c) SFWS: Stability path from 'Time 1 Flow' to 'Time 2 Flow': $z = 3.74$, $p < 0.001$; stability path from 'Time 1 Flow Metacognition' to 'Time 2 Flow Metacognition': $z = 6.44$, $p < 0.001$; causal path: $z = 3.60$, $p = 0.001$. The causal path is significant. Reversed causality path: $z = .08$, $p = 0.47$. The reversed causal path is not significant.