

**Investigating Team Processes:
Team Planning and the Rhythm of Teamwork**

Dissertation

zur Erlangung des Doktorgrades

der Philosophischen Fakultät der Christian-Albrechts-Universität zu Kiel

vorgelegt von

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Kiel, Februar 2021

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Tag der mündlichen Prüfung: 20.05.2021

Durch den Prodekan Prof. Dr. Michael Elmentaler

zum Druck genehmigt: 17.06.2021

„Es ist im Leben wie im Schachspiel:

Wir entwerfen einen Plan.

Dieser bleibt jedoch bedingt durch das,

was im Schachspiel dem Gegner,

im Leben dem Schicksal zu tun beliebigen wird.

Die Modifikationen, welche hierdurch unser Plan erleidet,

sind meistens so groß, dass er in der Ausführung

kaum noch an einigen Grundzügen zu erkennen ist.“

--Arthur Schopenhauer

ZUSAMMENFASSUNG

Im Fokus der vorliegenden Dissertation steht die Erforschung von Teamprozessen, die als entscheidender Einflussfaktor für emergente Zustände im Team und Ergebnisse der Teamarbeit gelten. Konkret wird im Rahmen des weitverbreiteten *Recurring Phase Model of Team Processes* Teamplanen als ein relevanter Teamprozess genannt. Dennoch wurden dessen unterschiedliche Teilprozesse in der Vergangenheit kaum untersucht bzw. inkonsistent differenziert, sodass bislang ein klares und vollständiges Bild des Teamplanungsprozesses fehlt. Ein erstes Ziel der vorliegenden Dissertation ist es, die relevanten Teilprozesse mit ihren unterschiedlichen Funktionen zu identifizieren und hinsichtlich ihrer Antezedenzen zu untersuchen.

Teamplanen steht darüber hinaus in engem Zusammenhang mit weiteren Teamprozessen (z.B. Reflexion) und ist ein über die Zeit betrachteter dynamischer Prozess. Auf theoretischer Ebene wird dies in dem *Recurring Phase Model of Team Processes* als *Rhythm of Team Task Accomplishment* („Rhythmus der Teamarbeit“) berücksichtigt, welcher als zyklischer Ablauf von Aktions- und Transitionsphasen bei der Aufgabenbearbeitung von Teams konzipiert wird. Obwohl eine empirische Untersuchung des Rhythmus der Teamarbeit einen wichtigen Beitrag leisten könnte, Teamdynamiken weiter zu verstehen und zu entschlüsseln, ist dies bislang nicht erfolgt. Ein zweites Ziel der vorliegenden Dissertation ist es, den Rhythmus der Teamarbeit als komplexes zeitliches Muster von Teamprozessen erstmals empirisch zu untersuchen und dessen zentrale Annahmen zu überprüfen.

Nachdem einleitend die zentralen Konstrukte der Dissertation erläutert und in den Forschungskontext eingebettet werden, folgen drei Studien zur empirischen Untersuchung dieser. Dabei beschäftigen sich Studie 1 und Studie 2 mit dem Konstrukt des Teamplanens, während in Studie 3 der Rhythmus der Teamarbeit untersucht wird.

Im Rahmen der ersten Studie wird ein prozessorientiertes Modell des Teamplanens vorgestellt sowie eine entsprechende vierdimensionale Skala aufbauend auf zwei Unterstudien mit

drei verschiedenen Stichproben entwickelt und validiert. Zusätzlich werden zwei eindimensionale Kurzskaleten für den Einsatz in spezifischen Kontexten (z.B. Panelstudien, Tagebuchstudien) entwickelt. Die Ergebnisse der Studie stützen die postulierte Multidimensionalität von Teamplanen und zeigen, dass die Skalen sowohl intern konsistent sind, sowie konvergente Validität und Kriteriumsvalidität bezüglich der Teamleistung besitzen. Die Studie liefert somit ein Planungsmodell, welches sich erstmals ausschließlich auf die beteiligten Teamplanungsprozesse und ihre unterschiedlichen Funktionen in Bezug auf die Zielerreichung konzentriert, sowie valide und reliable Skalen zur Untersuchung des gesamten Teamplanungsprozesses.

In Studie 2 wird mithilfe zweier Policy-Capturing Untersuchungen die multidimensionale Skala weiter validiert, aber vor allem der Einfluss von Situationsmerkmalen auf das Planungsverhalten von Teams untersucht. Aufbauend auf Theorien der Organisationspsychologie werden konkret die Effekte von Routine, Zeitdruck und Folgeschwere untersucht. Die Ergebnisse stützen dabei die mehrdimensionale Skala zum Teamplanen und zeigen insgesamt über beide Unterstudien hinweg, dass hoher Zeitdruck, hohe Aufgabenroutine und geringe Folgeschwere jeweils die Planungsabsichten in allen Dimensionen verringern. Damit liefert die Studie erste Anhaltspunkte zu Situationen, in denen Unternehmen Maßnahmen ergreifen und/oder Ressourcen bereitstellen könnten, um Teams zum Planen zu ermutigen, um so von der leistungssteigernden Wirkung des Teamplanens zu profitieren.

Während in Studie 1 und 2 der spezifische Prozess des Teamplanens untersucht wird, rückt in Studie 3 die Dynamik und die Abhängigkeit der verschiedenen Teamprozesse (z.B. Teamplanen, Teamkoordination) und das sich daraus ergebende zeitliche Muster in den Fokus. Mithilfe einer Laborstudie werden erstmals die zentralen Annahmen des Recurring Phase Models zum Rhythmus der Teamarbeit untersucht. Zu diesem Zweck wurde eine geeignete Methode zur Erfassung des Teamrhythmus entwickelt. Die Ergebnisse der Studie stützen dabei die zentralen Annahmen des Recurring Phase Models, dass Teams unterschiedliche Rhythmen während der Teamarbeit zeigen, diese in Abhängigkeit der Aufgabe variieren und zumindest

teilweise mit der Teamleistung verknüpft sind. Damit liefert die Studie neben ersten empirischen Befunden einen methodischen Ansatz, um die oft vernachlässigten komplexen zeitlichen Muster von Teamprozessen beschreiben und hinsichtlich ihrer Antezedenzen wie Konsequenzen untersuchen zu können.

Abschließend werden die Ergebnisse der drei Studien in den Forschungskontext eingebettet, kritisch bewertet und theoretische sowie praktische Implikationen erläutert.

ABSTRACT

This dissertation focuses on the investigation of team processes, which are regarded as a critical factor for team emergent states and for the result of team work. More precisely, team planning is named a relevant team process as part of the prevalent recurring phase model of team processes. Nevertheless, in the past its individual sub processes have only rarely or inconsistently been differentiated, which is why a clear and complete overview over team planning processes is missing so far. A first aim of this dissertation is to identify the relevant team planning processes and to examine them with regards to their antecedents.

Furthermore, team planning is closely connected with further team processes (e.g., re-flexion) and is a dynamic process over time. This is included in the recurring phase model of team process on a theoretical level as rhythm of team task accomplishment ('rhythm of teamwork'), which is conceptualized as a cyclical procedure of action and transition phases during the task accomplishment of teams. Even though an empirical examination of the rhythm of team work could produce an important contribution to further understand and decode team dynamics, such an examination has yet to happen. A second aim of this dissertation is to empirically examine the rhythm of teamwork as a complex temporal pattern of team processes for the first time and to review its central assumptions.

After preliminarily explaining the central constructs of the dissertation and embedding them into the research context, three studies on its empirical examination follow. Study 1 and Study 2 concern themselves with the construct of team planning while Study 3 examines the rhythm of team work.

In the scope of the first study, a process-oriented model of team planning is introduced. Additionally, a respective four-dimensional scale and two one-dimensional short scales—for use in specific contexts (e.g., panel studies, diary studies)—are developed and validated on the basis of two sub studies with three different samples. The results of the study support the pos-

tulated multidimensionality of team planning and show that the scales both show internal consistency as well as convergent validity and criterion-related validity concerning team performance. The study therefore offers a planning model, which is the first to exclusively focus on the involved team planning process and their various functions regarding goal achievement, as well as valid and reliable scales for the exploration of overall team planning processes.

Study 2 further validates the multidimensional scale with the help of two policy-capturing sub studies but it also examines the effect of situational factors on the planning behavior of teams. Drawing on the theories of organizational psychology, the effects of routine, time pressure and decision importance are specifically examined. The results support the validity of the multidimensional scale of team planning and generally show across both sub studies that planning intentions in all dimensions are decreased by intense time pressure, high task routine and small decision importance. The study therefore offers first indications for situations, in which companies could offer resources or adopt measures to encourage teams to plan, in order to profit from the performance-enhancing effect of team planning.

While Study 1 and Study 2 examine the specific process of team planning, Study 3 focuses on the dynamic and the dependency of the various team processes (e.g., team planning, team coordination) and the resulting temporal pattern. By use of a laboratory study the central assumptions of the recurring phase model of team processes regarding the rhythm of team work are examined for the first time. A suitable method for the capturing of team rhythm has been specifically designed for this purpose. The results of the study thereby support the central assumptions of the recurring phase model of team processes, namely that teams show different rhythms during team work, that these vary with the task and that they are at least partially connected to the team's performance. The study therefore not only offers first empirical findings but also a methodological approach to describe the complex temporal patterns of team processes and to examine them with regard to their antecedents as well as their consequences.

Concluding, the results of the three studies are embedded into the research context, critically evaluated and both theoretical as well as practical implications are explained.

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1 EINLEITUNG

1 EINLEITUNG

Der Einsatz von Teams in der organisationalen Arbeit ist schon seit einiger Zeit keine Ausnahme mehr und entspricht heutzutage in einigen Industriezweigen (z.B. Medizin, Militär) sogar der Regel (Bisbey & Salas, 2019). Teams werden daher nicht selten als „life force of organizations“ bezeichnet (z.B. Driskell et al., 2017, S. 232) und aufgrund ihrer Vorzüge gegenüber individuenzentrierter Arbeitsformen (Goodwin et al., 2009; Kozlowski & Ilgen, 2006; Mathieu et al., 2008) insbesondere zur Bewältigung wichtiger und komplexer Aufgaben eingesetzt (Salas et al., 2017). Somit stellen sie einen entscheidenden Faktor für den Organisationserfolg dar, der durch jahrzehntelange Forschung zur Teamleistung belegt ist (Bisbey & Salas, 2019; Kozlowski & Bell, 2013; Mathieu et al., 2008).

Der Einsatz von Teams in Organisationen führt jedoch nicht automatisch zu einer verbesserten Arbeitsleistung, sondern ist unter anderem abhängig von der Art und Weise, wie ein Team seine Aufgaben erledigt (Antoni & Bungard, 2004; Bisbey & Salas, 2019; Hackman, 2002). Vermehrt rückten daher Teamprozesse und deren Zusammenhang zur Teamleistung in den Fokus wissenschaftlicher Betrachtungen (z.B., Ilgen et al, 2005; Leenders et al., 2016). Teamprozesse werden definiert als die voneinander abhängigen Handlungen der Teammitglieder, durch die die Aktivitäten einzelner Mitglieder auf die Erreichung der gemeinsamen Ziele ausgerichtet werden (Marks et al., 2001). Sie stellen demnach Mechanismen dar, die die Fähigkeit von Teammitgliedern hemmen oder unterstützen, ihre Fertigkeiten, Kompetenzen und Verhaltensweisen aufeinander abzustimmen (Kozlowski & Bell, 2013).

Um die Funktionsweise von Teams weiter zu entschlüsseln und somit ein tiefergehendes Verständnis dafür zu entwickeln, wann Teams besonders effektiv sind, ist es entscheidend, spezifische Teamprozesse sowie die Abhängigkeit zwischen verschiedenen Teamprozessen genauer zu betrachten (z.B. Bisbey & Salas, 2019; Kozlowski, 2015; Kozlowski & Chao, 2018; Ilgen et al., 2005; Leenders et al., 2016). Hierzu gehören sowohl Antezedenzen und Konsequenzen der Teamprozesse als auch komplexe zeitliche Muster, die sich aus dem Zusammenspiel mehrerer

Teamprozesse ergeben. Anhaltspunkte diesbezüglich bietet das vielfach zitierte *Recurring Phase Model of Team Processes* von Marks et al. (2001), welches bereits als Grundlage einer Vielzahl empirischer Studien in der Teamforschung dient. In diesem wird *Teamplanen* als relevanter Teamprozess identifiziert und ein *Rhythm of Team Task Accomplishment* („Rhythmus der Teamarbeit“) postuliert, welcher sich aus dem Muster der einzelnen und miteinander agierenden Teamprozesse ergibt. Aufbauend auf empirischen Untersuchungen zu diesen beiden Konstrukten können geeignete Teamtrainingsinterventionen mit dem Ziel, die Teameffektivität und damit die Leistung von Organisationen weiter zu steigern, abgeleitet werden. Im Rahmen der vorliegenden Dissertation werden zwei Ziele verfolgt. Zum einen sollen die relevanten Teilprozesse des Teamplanens mit ihren unterschiedlichen Funktionen identifiziert und hinsichtlich ihrer Antezedenzen untersucht werden. Zum anderen soll der Rhythmus der Teamarbeit als komplexes zeitliches Muster von Teamprozessen erstmals empirisch untersucht und zentrale Annahmen des Modells überprüft werden.

Das vorliegende Kapitel befasst sich mit dem theoretischen Rahmen dieser Dissertation. Es werden zentrale Begriffe der Teamforschung erläutert und Teameffektivitätsmodelle dargestellt. Zudem werden die zentralen Konstrukte der vorliegenden Arbeit, Teamplanen und der Rhythmus der Teamarbeit, definiert. In Kapitel 2 wird im Rahmen der ersten Studie ein prozessorientiertes Modell des Teamplanens vorgestellt sowie Skalen zur Erfassung von Teamplanen entwickelt und validiert, während in Kapitel 3 der Einfluss von Situationsmerkmalen auf das Planungsverhalten von Teams untersucht wird. In Kapitel 4 wird ein methodischer Ansatz zur Erfassung des Rhythmus der Teamarbeit präsentiert sowie die zentralen Annahmen zu diesem innerhalb des *Recurring Phase Model of Team Processes* untersucht. Das abschließende Kapitel 5 fasst die Ergebnisse der vorherigen Kapitel zusammen, diskutiert diese hinsichtlich ihrer Limitationen und gibt Implikationen für die Forschung und Praxis.

1.1 Zentrale Begriffe der Teamforschung

Im Folgenden werden zunächst Teams definiert und die Begriffe des *Team-* und *Taskwork* voneinander abgegrenzt. Als zentrales Konstrukt der Teamforschung wird zudem die Teameffektivität erläutert.

1.1.1 Teams

Teams werden als komplexe dynamische Systeme beschrieben, die aus zwei oder mehr voneinander abhängigen und miteinander agierenden Personen bestehen, um ein gemeinsames Ziel zu erreichen (Bisbey & Salas, 2019). Während oftmals die Begriffe *Teams* und *Gruppe* synonym verwendet werden (z.B. Kozlowski & Bell, 2013, Mathieu et al., 2019), grenzen Bisbey und Salas (2019) diese deutlich voneinander ab. Dabei lehnen sie sich an der weitverbreiteten und umfangreichen Definition von Kozlowski und Bell (2003) an, nach denen Arbeitsteams (a) aus zwei oder mehr Personen bestehen; (b) existieren, um relevante Aufgaben einer Organisation zu erfüllen; (c) mindestens ein gemeinsames Ziel teilen; (d) aufgabenbezogene Abhängigkeiten aufweisen (zum Beispiel im Zusammenhang zum Arbeitsfluss, Zielen, Wissen und Ergebnissen); (e) sozial interagieren; (f) Grenzen zu anderen Einheiten wahren; und (g) in einen organisationalen Kontext eingebettet sind, der sie in ihren Handlungen begrenzt und gleichzeitig den Austausch mit anderen Einheiten der Organisation beeinflusst und regelt. Erfüllt eine Einheit von Individuen eines dieser Kriterien nicht, stellt es nach Bisbey und Salas (2019) kein Team, sondern eine Gruppe dar.

Teams treten darüber hinaus in vielen unterschiedlichen Formen auf, sodass es eine Vielzahl an Bemühungen gibt, diese weiter zu klassifizieren (siehe Kozlowski & Bell, 2013 für einen Überblick). Zu berücksichtigen ist im Rahmen der Teamforschung, dass verschiedene Arten von Teams unterschiedlichen Anforderungen ausgesetzt sind und daher ganz unterschiedlich funktionieren können (Mathieu et al., 2008). Im Fokus der vorliegenden Dissertation stehen *Self-managed Teams*, deren Einsatz in Organisationen weitverbreitet ist (Markova &

Perry, 2014). Self-managed Teams zeichnen sich durch die Autorität und Verantwortung aus, Entscheidungen bezüglich der Arbeitsweise des Teams (*wie* wird die Aufgabe bearbeitet) selbst zu treffen (Manz & Sims, 1987; Yukl, 1998). In diesen Teams ist in der Regel daher keine Führungskraft integriert (Solansky, 2008). Durch self-managed Teams sollen die Vorteile von Teamarbeit genutzt werden, ohne unter den hohen Prozessverlusten in traditionellen Teams (z.B. Kommunikationsstörungen zwischen Team und Führungskraft) zu leiden (Manz, 1992).

1.1.2 Teamwork und Taskwork

Wie bereits erwähnt führt der Einsatz von Teams in Organisationen nicht automatisch zu einer verbesserten Arbeitsleistung, sondern ist unter anderem abhängig von der Art und Weise, wie ein Team seine Aufgabe erledigt (Bisbey & Salas, 2019). Im Rahmen der Teamforschung wird daher zwischen *Taskwork* und *Teamwork* unterschieden (z.B. Marks et al. 2001; McIntyre & Salas, 1995). Während *Taskwork* beschreibt, *was* ein Team tut und damit „a team’s interactions with tasks, tools, machines, and systems“ (Bowers et al., 1997, S. 90) darstellt, beschreibt *Teamwork*, *wie* ein Team seine Aufgabe erledigt und damit wie die einzelnen Aufgabenaktivitäten der Teammitglieder ausgerichtet, koordiniert und überwacht werden. Generell sind beide Komponenten notwendig, damit ein Team sein Ziel erreicht (Salas et al., 2015). Im Gegensatz zu *Teamwork* ist *Taskwork* allerdings aufgabenspezifisch und hängt maßgeblich von dem Wissen, den Erfahrungen und Kompetenzen der Teammitglieder ab. *Teamwork* hingegen ist auf andere Aufgaben übertragbar und führt im besten Falle zu einer Leistungssteigerung, sodass die Teamleistung größer ist als die Summe der Einzelleistungen (Bisbey & Salas, 2019). Auf dieser Unterteilung aufbauend konzentrierte sich ein großer Teil der Teamforschung auf den Zusammenhang zwischen spezifischen Teamprozessen (als Elemente von *Teamwork*) und der Teameffektivität (z.B. LePine et al., 2008).

1.1.3 Teameffektivität

Teams werden von Unternehmen meist mit der Hoffnung eingesetzt, dass diese eine bessere Leistung erzielen als Individuen. Von besonderer Bedeutung ist aus praktischer Sicht daher die Teameffektivität. Teameffektivität oder auch Teamleistung sind Begriffe, die im Allgemeinen das Ergebnis der Arbeit im Team beschreiben (Bisbey & Salas, 2019). In der Literatur finden sich unterschiedliche Definitionen und Konzeptionen. Teameffektivität wird dabei meist als multidimensionales Konstrukt verstanden, welches sich zum Beispiel durch interne Kriterien (d.h. Mitgliederzufriedenheit, Teamfähigkeit) als auch auf externe Kriterien (d.h. Produktivität, Leistung) beschreiben lässt (Hackman, 1987). Mathieu und Gilson (2012) unterscheiden bei den externen Kriterien drei Dimensionen: Produktivität (Form von quantitativen Zählungen einer Einheit, z.B. abgeschlossene Aufträge); Effizienz (Form von quantitativen Zählungen von produzierten Einheiten, definiert relativ zu einem Standard oder einer Benchmark); und Qualität (Bewertung des Wertes oder des Wertes von Outputs). Insgesamt liegt keine allgemeine Metrik vor, um Teameffektivität zu erfassen, da dessen Bedeutung vom Kontext abhängig ist. In der vorliegenden Dissertation wurden sowohl Maße der Produktivität als auch der Qualität genutzt.

Aus praktischer Sicht besonders relevant ist die Frage, warum einige Teams effektiver sind als andere, und damit die Fragen nach den Determinanten der Teameffektivität (Salas et al., 2009; Kozlowski & Ilgen, 2006; Ilgen et al., 2005). Wichtige Anhaltspunkte diesbezüglich bieten Teameffektivitätsmodelle, auf die im folgenden Abschnitt näher eingegangen wird.

1.2 Teameffektivitätsmodelle

Die zahlreichen Theorien zur Teamarbeit (siehe für einen Überblick Chidambaram & Bostrom, 1997; Räcke 2020) können allgemein in Teameffektivitätsmodelle und Teamentwicklungsmodelle unterteilt werden. Während Teameffektivitätsmodelle (z.B. McGrath, 1964; McGrath & Tschan, 2004) beschreiben, wie ein Team eine Aufgabe bearbeitet, beschreiben

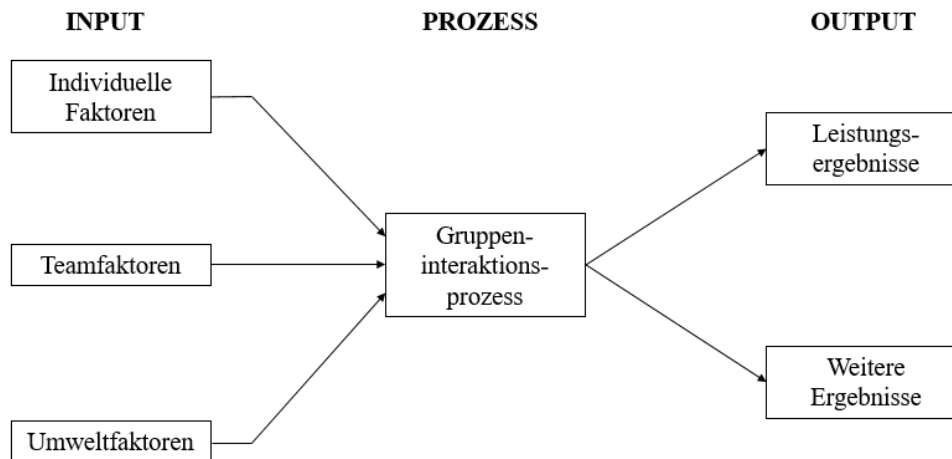
Teamentwicklungsmodelle, wie sich Teams qualitativ im Laufe der Zeit verändern (z.B. Dunphy, 1974; Tuckman, 1965). Als Grundlage der vorliegenden Dissertation dienen Teameffektivitätsmodelle, von denen zwei im Folgenden näher beschrieben werden.

1.2.1 Input-Process-Output Modell

Als besonders einflussreiches Teameffektivitätsmodell gilt das Input-Process-Output (IPO) Modell (Hackman & Morris, 1975; McGrath, 1964). Zentrale Annahme des Modells ist es, dass Gruppeninteraktionsprozesse eine entscheidende Rolle dabei spielen, wie Inputfaktoren zu Outputfaktoren konvertiert werden. Als Inputfaktoren werden dabei vorausgehende Faktoren beschrieben, die die Interaktionen der Mitglieder ermöglichen, aber auch beschränken. Inputfaktoren können unterteilt werden in individuelle Eigenschaften der Teammitglieder (z.B. Persönlichkeitseigenschaften), Faktoren auf Teamebene (z.B. Teamzusammensetzung) sowie Umweltfaktoren (z.B. Aufgabenstruktur). Als Gruppeninteraktionsprozesse beschreiben die Autoren dagegen die fortwährenden Interaktionsprozesse, die zwischen den Teammitgliedern bei der Bearbeitung einer gemeinsamen Aufgabe auftreten. Oftmals werden diese auch als Teamprozesse beschrieben. Outputfaktoren beziehen sich auf die Ergebnisse der Teamaktivitäten. Darunter sind sowohl die Teamleistung aber auch andere Parameter (z.B. Zufriedenheit, Engagement) zu fassen. Das Modell ist in Abbildung 1.1 dargestellt.

Abbildung 1.1

Input-Process-Outcome Modell (in Anlehnung an Hackman & Morris, 1975; McGrath, 1984)



Das IPO Modell diente lange Zeit als Leitfaden für Forschung über Arbeitsteams (Mathieu et al., 2019), wurde allerdings vermehrt hinsichtlich zweier Aspekte kritisiert. Zum einen werden Teamprozesse innerhalb des Modells sehr weit gefasst, sodass unter dem Deckmantel des Modells zahlreiche Variablen untersucht wurden, die keine Teamprozesse darstellen (Ilgen et al., 2005; Marks et al., 2001). Dies betrifft vor allem Variablen, die nicht den Interaktionsprozess kennzeichnen, sondern sich auf Einstellung, Werte, Kognitionen oder motivationale Aspekte der Teammitglieder beziehen (z.B. geteilte mentale Modelle, Teamkohäsion). Zum anderen wird kritisiert, dass die Variabilität von Teamprozessen im Zeitverlauf nicht angemessen widerspiegelt wird, sodass die zeitliche Dynamik von Teamarbeit und damit die Komplexität der Realität nicht wiedergegeben werden kann (Callea et al., 2014; Kozlowski & Ilgen, 2006; Mannix & Jehn, 2004). Demzufolge können auch die vielfältigen Interaktionseffekte zwischen den Variablengruppen nicht korrekt dargestellt werden (Ilgen et al., 2005). Ursächlich dafür scheint laut Kozlowski (201) die kausale Interpretation der IPO-Heuristik, verbunden mit

der Darstellung der von Natur aus dynamischen Teamprozesse durch eine Box (siehe Abbildung 1.1).

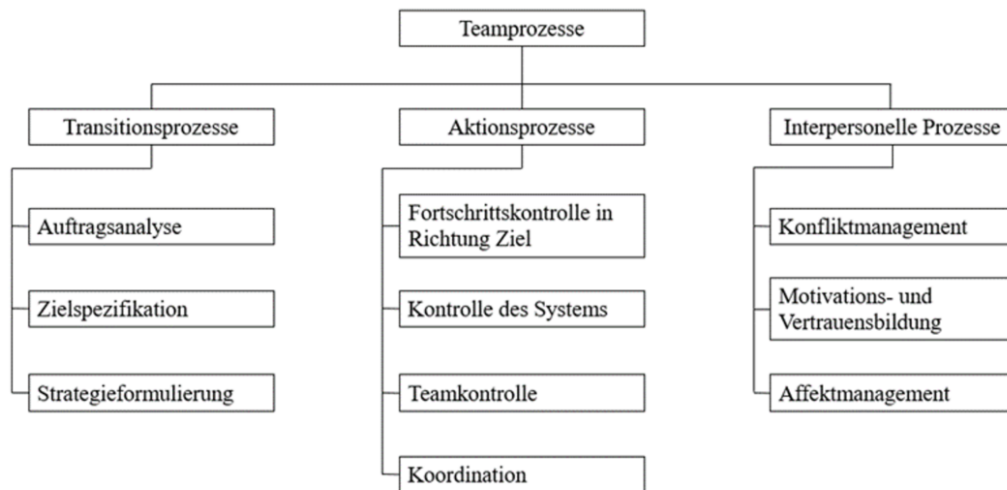
Es liegen zahlreiche konzeptionelle Arbeiten vor, die auf dem IPO Modell basieren, dieses erweitern oder modifizieren (z.B. Ilgen et al., 2005; Gladstein, 1984; Tannenbaum et al., 1992). Eines davon ist das weitverbreitete Recurring Phase Model of Team Processes von Marks et al. (2001), welches im Rahmen der vorliegenden Dissertation eine zentrale Rolle einnimmt und daher im Folgenden dargestellt wird.

1.2.2 Recurring Phase Model of Team Processes

Marks et al. (2001) bauen in ihrem Recurring Phase Model of Team Processes auf dem IPO Modell (Hackman & Morris, 1975; McGrath, 1964) auf und greifen dabei die oben genannten Kritikpunkte auf. Zum einen definieren sie das Konstrukt der Teamprozesse deutlich trennschärfer als „Members’ interdependent acts that convert inputs to outcomes through cognitive, verbal, and behavioral activities directed toward organizing taskwork to achieve collective goals.“ (Marks et al., 2001, S. 357). Teamprozesse sind demnach immer bewusst auf das gemeinsame Ziel des Teams gerichtete Aktivitäten. Deutlich davon abzugrenzen sind laut Marks et al. (2001) kognitive, motivationale und affektive emergente Zustände des Teams. Emergente Zustände resultieren dabei aus dem Teamkontext, Inputfaktoren, Prozessen und Ergebnissen und sind über die Zeit veränderbare Zustände. Marks et al. (2001) unterscheiden darüber hinaus Transitionsprozesse von Aktionsprozessen und interpersonellen Prozessen. Während Transitionsprozesse (z.B. Teamplanen) sich mit der Evaluation und Planung von Handlungen zur Zielerreichung beschäftigen, sind Aktionsprozesse jene, bei denen das Team Handlungen ausführt, die direkt zur Zielerreichung führen (z.B. Koordination). Interpersonelle Prozesse hingegen dienen dem Management zwischenmenschlicher Beziehungen (z.B. Konfliktmanagement). Eine Übersicht der Taxonomie der Teamprozesse von Marks et al. (2001) ist in Abbildung 1.2 dargestellt.

Abbildung 1.2

Taxonomie von Teamprozessen (Eigene Darstellung in Anlehnung an Marks et al., 2001)



Zum anderen greifen Marks et al. (2001) die Dynamik von Teamarbeit auf, indem sie die Teamarbeit nicht mehr im Kontext eines einzelnen IPO Zyklus betrachten, sondern davon ausgehen, dass ein Team während einer bestimmten Aufgabe eine Serie von IPO Einheiten (McGrath, 1964), sogenannten Episoden, durchläuft. Das Output der einen Einheit, bildet dabei den Input der nächsten Einheit. Dabei gehen sie davon aus, dass während dieser Einheiten unterschiedliche Teamprozesse im Fokus stehen, und unterscheiden darauf aufbauend Transitionsphasen von Aktionsphasen. Transitionsphasen definieren sie dabei als „periods of time when teams focus primarily on evaluation and/or planning activities to guide their accomplishment of a team goal or object“ (Marks et al., 2001, S. 360) und Aktionsphasen als „periods of time when teams are engaged in acts that contribute directly to goal accomplishment“ (Marks et al., 2001, S. 360). Interpersonelle Prozesse bilden dabei keine eigene Phase, sondern treten gleichermaßen in Transitions- und Aktionsphasen auf. Zentrale Annahme des Recurring Phase Models ist, dass ein Team während der Aufgabenbearbeitung mehrere Aktions- und Transitionsphasen hintereinander durchläuft. Die Phasen dienen dabei der Identifikation, wann welche

Art von Teamprozessen besonders relevant ist. In ihrem Modell berücksichtigen die Autoren zudem die Tatsache, dass Teams in der Realität oft unterschiedliche Aufgaben zeitgleich bearbeiten müssen, sodass sie sowohl von sequenziellen als auch von simultanen IPO Zyklen innerhalb eines Teams ausgehen.

Das Recurring Phase Model of Team Processes ist in der Teamforschung weitverbreitet und dient unter anderem als Grundlage für konzeptionelle Arbeiten, das Ableiten von Trainingsdesigns und als Basis für Forschungsdesigns (für einen Überblick siehe McComb & Kennedy, 2020). Während die Taxonomie der Teamprozesse (siehe Abbildung 1.2) bereits metaanalytisch gestützt werden konnte (LePine et al., 2008), liegen insgesamt nur wenige Befunde bezüglich der angenommen sequenziellen als auch simultanen Transitions- und Aktionsphasen in Form mehrerer IPO Zyklen vor (für einen Überblick siehe McComb & Kennedy, 2020).

Im Folgenden werden zwei Aspekte des Recurring Phase Models, Teamplanen und der Rhythmus der Teamarbeit, als zentrale Konstrukte der vorliegenden Dissertation näher betrachtet. Dabei wird am Ende des jeweiligen Kapitels der Forschungsbedarf kurz skizziert, der ausschlaggebend für die drei Studien der Dissertation war.

1.2.2.1 Teamplanen

Als einen entscheidenden Team- und Transitionsprozess benennen Marks et al. (2001) Teamplanen (*strategy formulation*) und definieren es als „development of alternative courses of action for mission accomplishment“ (S. 365). Teamplanen umfasst laut den Autoren dabei sowohl Entscheidungen darüber, wie das Team seine gemeinsamen Ziele erreichen will, als auch Diskussion zu den Erwartungen der Teammitglieder, den Austausch über aufgabenbezogene Informationen, die Priorisierungen einzelner Ziele und Aufgaben, die Rollenverteilungen zwischen den Teammitgliedern und die Kommunikation des Plans an alle Teammitglieder. Gutes Teamplanen zeichnet sich dabei dadurch aus, dass situative und zeitliche Einschränkungen, Ressourcen des Teams, Erfahrungen und Fähigkeiten der Mitglieder sowie die sich unter Umständen verändernden Umweltbedingungen berücksichtigt werden. Der sich daraus ergebene

Plan sollte letztendlich Informationen darüber enthalten, wann welche Handlungen wie ausgeführt werden, sowie einzelne Rollen und Verantwortlichkeiten den Teammitgliedern zuweisen.

Marks et al. (2001) unterteilt Teamplänen in die drei Teilprozesse des *deliberate planning*, *contingency planning* und *reactive adjustment*. Unter *deliberate planning* wird die Entwicklung einer generellen Strategie zur Erfüllung der Aufgabe verstanden. Dieser Prozess tritt oftmals zu Beginn der Aufgabenbearbeitung von Teams auf. *Contingency planning* beschreibt die Entwicklung alternativer Pläne, die auf das Eintreten antizierbarer Umweltveränderungen ausgelegt sind. Diese sind damit an bestimmte Auslöser geknüpft und folgen einer “Wenn-Dann-Logik“. *Reactive adjustment* umfasst die Änderung der bestehenden Strategie oder Pläne als Reaktion auf unerwartete Veränderungen, während die Bearbeitung der Aufgabe zu diesem Zeitpunkt bereits angefangen hat. *Reactive adjustment* tritt also dann auf, wenn unerwartete Ereignisse eintreten oder Fehler im Plan entdeckt werden, die eine Anpassung der Strategie erfordern.

Obwohl Teamplänen sowohl in Theorien auf individueller als auch auf teambezogener Ebene als relevanter Faktor für die Leistung betrachtet wird (z.B. Carver & Scheier, 1998; Hacker, 2005; Mumford et al., 2015; West, 2000), wurde diesem im Vergleich zu anderen Teamprozessen wie *Adaptation* (Baard et al., 2014) und *Reflexivität* (Konradt et al., 2015; Moreland & McMinn, 2010) bislang nur wenig Aufmerksamkeit in der empirischen Teamforschung geschenkt und meist als eindimensionales Konstrukt betrachtet. Letzteres wurde aufgrund der begrenzten Inhaltsvalidität und eingeschränkten prädiktiven Validität bereits kritisiert (Fisher, 2014). Eine multidimensionale Konzeption von Teamplänen—wie die von Marks et al. (2001)—scheint daher angemessen, um der Vielschichtigkeit des Konstrukts mit seinen einzelnen Teilprozessen (z.B., Ilgen et al., 2005, Smith et al., 1990) gerecht zu werden. Bei einer näheren Betrachtung dieser Konzeption fallen jedoch zwei Aspekte auf. Zum einen werden Teamplanungsprozesse, die wiederholt in der Theorie diskutiert werden (z.B. Prognose, Scan-

nen der Umweltbedingungen; Mumford et al., 2015), von Marks et al. (2001) nicht berücksichtigt. Der Planungsprozess mit seinen unterschiedlichen Teilprozessen wird demzufolge nicht vollständig beschrieben. Zum anderen beruht die Unterteilung der Planungsprozesse von Marks et al. (2001) auf unterschiedlichen Kriterien und ist damit inkonsistent. So werden Planungsprozesse einerseits hinsichtlich ihrer Funktion unterschieden: Wird ein allgemeiner Plan (deliberate planning) oder Wenn-Dann Pläne für vorhersehbare Veränderungen (contingency planning) entwickelt? Andererseits grenzen sie reactive adjustment als Planungsprozess aufgrund seines zeitlichen Auftretens ab: Während deliberate und contingency planning die a priori Diskussion darüber beinhalten, wie die Aufgabe erledigt werden kann, bezieht sich reactive adjustment auf die Anpassung von Strategien zu einem Zeitpunkt in der die Aufgabenbearbeitung bereits begonnen hat (vgl. Fisher, 2014). Unklar bleibt an dieser Stelle, inwiefern die Änderung der Strategie planvoll oder rein reaktiv erfolgen und damit als bewusster und gemeinsamer Prozess der Teammitglieder zu bewerten ist.

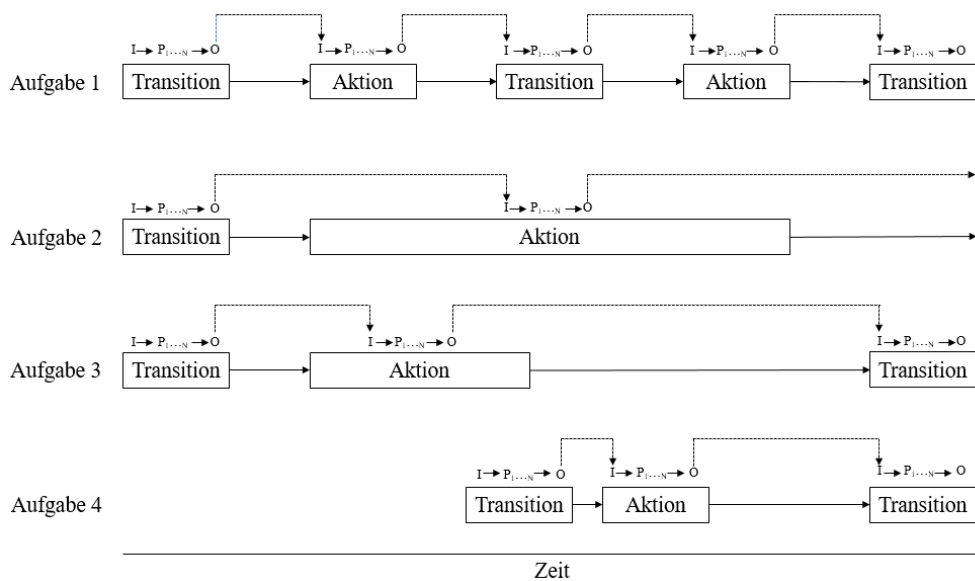
Ursächlich für die inkonsistente Konzeption und die damit verbundene Forschungslücke, die zu einem verzerrten Bild des Teamplanungsprozesses führen könnte, scheint das Fehlen einer Theorie zu sein, die sich ausschließlich auf die beteiligten Teamplanungsprozesse und ihre unterschiedlichen Funktionen in Bezug auf die Zielerreichung konzentriert. Offen bleibt daher die Frage, was die wesentlichen Prozesse des Teamplanens sowie ihre Antezedenzen und Konsequenzen sind. Angesichts empirischer Befunde hinsichtlich des positiven Zusammenhangs zwischen Teamplanen und Leistung (z.B. Fisher, 2014; Konradt et al., 2021; Mehta et al., 2009; Weingart, 2006) wäre es für Unternehmen wertvoll zu wissen, ob Teams aufgrund äußerer Umstände planen oder nicht. Unternehmen könnten dann Maßnahmen ergreifen oder Ressourcen bereitstellen, um Teams zur Planung zu ermutigen, um so von der leistungssteigernden Wirkung des Teamplanens zu profitieren.

1.2.2.2 Rhythmus der Teamarbeit

Als Rhythmus der Teamarbeit beschreiben Marks et al. (2001) das komplexe zeitliche Muster, welches sich aus dem Zusammenspiel der einzelnen Teamprozesse als Ablauf mehrerer Transitions- und Aktionsphasen ergibt. Die Autoren merken dabei an, dass diese Phasen in Abhängigkeit der Aufgabe in unterschiedlichen Längen und mit unterschiedlichen Abständen dazwischen auftreten können. Mögliche Rhythmen von Teamarbeit sind in Abbildung 1.3 dargestellt.

Abbildung 1.3

Rhythmen der Teamarbeit (in Anlehnung an Marks et al., 2001)



Anmerkungen. (I = Input, P = Process, O = Outcome).

Während bei Aufgabe 1 ein regelmäßiger Rhythmus mit einem ausgewogenen Verhältnis von Aktions- und Transitionsphasen auftritt, erfordert Aufgabe 2 eine deutlich längere Aktionsphase. Zudem können, wie in Aufgabe 3 und 4 dargestellt, Pausen zwischen den Phasen auftreten. Die Häufigkeit, die Länge und die Vorhersagbarkeit der Wechsel von Transitions- und Aktionsphasen sind laut Autoren dabei von einer Reihe von Faktoren abhängig, wie den

gemeinsamen Zielen, der Umwelt, Normen oder auch der Führung. Die Identifikation der Transitions- und Aktionsphasen ist relevant, um nicht nur zu verstehen, *welche* Teamprozesse (z.B. Teamplänen) für die Zielerreichung entscheidend sind, sondern auch, *zu welchem Zeitpunkt* diese Teamprozesse entscheidend sind (Marks et al., 2001). Der Rhythmus der Teamarbeit schafft so eine zeitliche Ordnung der Aufgabenbearbeitung, durch den die einzelnen Handlungen der Teammitglieder auch für ebendiese vorhersagbarer werden. Darüber hinaus ermöglicht der Rhythmus der Teamarbeit, Teamdynamiken über einen längeren Zeitraum von Stunden oder Tagen abzubilden und die Strategien und Taktiken der Aufgabenbewältigung sowie deren Zusammenhänge zur Teameffektivität zu identifizieren. Darauf aufbauend könnten evidenzbasierte Implikationen für die Praxis abgeleitet werden mit dem Ziel, die Teamarbeit und letztendlich die Teameffektivität zu verbessern.

Obwohl das Recurring Phase Model of Teamprocesses in der Teamforschung weitverbreitet ist (für einen Überblick siehe McComb & Kennedy, 2020) und die empirische Untersuchung des Rhythmus der Teamarbeit einen wichtigen Beitrag leisten könnte, Teamdynamiken weiter zu verstehen und zu entschlüsseln, ist dies bislang nicht erfolgt. Der Rhythmus der Teamarbeit bleibt damit bislang lediglich eine theoretische Überlegung. Ursächlich für diese Forschungslücke scheint insbesondere die Herausforderung zu sein, komplexe zeitliche Phänomene wie den Rhythmus der Teamarbeit methodisch adäquat zu erfassen (Ancona et al., 2001; McComb & Kennedy, 2020). Offen bleibt damit die Frage, ob Teams sich beim Bearbeiten einer Aufgabe wirklich unterschiedlichen Rhythmen bzw. Rhythmustypen zuordnen lassen und diese, wie von Marks et al. (2001) angenommen, mit der Aufgabe variieren. Von Interesse ist dabei aus organisationaler Sicht zudem ein möglicher Zusammenhang zur Teameffektivität.

1.3 Ausblick auf die folgenden Kapitel

Die Bedeutung von Teamprozessen im Rahmen der Teameffektivitätsforschung ist Gegenstand zahlreicher theoretischer und empirischer Arbeiten. Im Fokus der vorliegenden kumulativen Dissertation stehen das Konstrukt des Teamplanens sowie der Rhythmus der Teamarbeit als komplexes zeitliches Muster der Gesamtheit der Teamprozesse. Von besonderem Interesse ist dabei die Frage, was relevante Prozesse des Teamplanens sowie Antezedenzien dieser sind. Zudem ergibt sich aus den oben genannten Überlegungen die Frage, ob der Rhythmus der Teamarbeit empirisch erfasst und dessen zentrale Annahmen belegt werden können. Die nachfolgenden Abschnitte legen dar, wie die oben skizzierten Forschungslücken mithilfe dreier Studien bearbeitet wurden. Dabei beschäftigen sich Studie 1 und Studie 2 mit dem Konstrukt des Teamplanens, während in Studie 3 der Rhythmus der Teamarbeit untersucht wird. In Kapitel 5 werden die Ergebnisse der drei Studien übergreifend und abschließend diskutiert.

1.3.1 Kapitel 2: Studie 1

In Studie 1 werden die relevanten Teilprozesse des Teamplanens im Rahmen eines neuen prozessorientierten Modells identifiziert und darauf aufbauend ein geeignete Skalen zur Untersuchung des gesamten Teamplanungsprozesses entwickelt und validiert.

Zunächst wird daher die Notwendigkeit eines neuen Modells zum Teamplanen verdeutlicht. Basierend auf Ähnlichkeiten zwischen bestehenden Planungsmodellen (Hacker, 2005, Dörner 2016; Mumford et al., 2015) sowie sich wiederholenden Annahmen in der Literatur wurden Exploration, strategische Planung, Detailplanung und Prognose als Teilprozesse des Teamplanens postuliert. Darauf aufbauend wurde eine multidimensionale Skala entwickelt. Items bisheriger Skalen wurden dafür von mehreren ExpertInnen den vier Teilprozessen zugeordnet sowie basierend auf den Definitionen der vier Teilprozesse neu entwickelt. Zusätzlich wurden explorative Interviews mit Studierenden und Arbeitnehmenden durchgeführt, um die Vollständigkeit der Items weiter abzusichern. Die Items wurden anschließend von mehreren

ExpertInnen im Hinblick auf die Verständlichkeit, Dopplungen und Passung bewertet, reduziert und adaptiert. Da Zeit und Kosten in der Praxis eine wichtige Rolle spielen und den Einsatz langer Skalen beispielweise im Kontext von Panelstudien verhindern könnten (z.B. Crawford et al., 2001; Woods & Hampson, 2005), wurden parallel zwei weitere Skalen entwickelt: eine eindimensionale Kurzform-Skala und eine Ein-Item-Skala.

Zur Validierung der drei Skalen wurden zunächst zwei Stichproben, bestehend aus 206 Studierenden und 210 Arbeitnehmenden, verwendet. Basierend auf den Daten beider Stichproben wurde die Anzahl der Items reduziert und die sich daraus ergebenden Skalen hinsichtlich ihrer psychometrischen Qualität untersucht. Mithilfe konfirmatorischer Faktorenanalysen konnte die vierfaktorielle Struktur der multidimensionalen Skala bestätigt werden. Ein nomologisches Netzwerk diente der Untersuchung der konvergenten Validität, die für alle drei Skalen bestätigt werden konnte.

In einer dritten Stichprobe, bestehend aus 40 Studierendenteams, wurden die Gütekriterien der Skalen in einer Laborstudie weiter überprüft und zudem die Kriteriumsvalidität aller drei Skalen betrachtet. Alle drei Skalen zeigten dabei signifikante Zusammenhänge zur Teamleistung.

Die Ergebnisse weisen insgesamt darauf hin, dass Teamplänen mit allen drei Skalen valide erfasst werden kann. Die abschließende Diskussion stellt die Vorteile einer multidimensionalen Betrachtungsweise des Teamplanungsprozesses heraus, geht aber auch auf die Notwendigkeit von Kurzskalen in spezifischen Forschungskontexten ein. Neben Limitationen und zukünftigem Forschungsbedarf der vorliegenden Studie werden vor allem praktische Implikationen diskutiert.

1.3.2 Kapitel 3: Studie 2

Nachdem in Studie 1 ein Modell sowie Skalen zum Teamplänen entwickelt und validiert wurden, steht in Studie 2 der Einfluss von Situationsmerkmalen auf das Planungsverhalten von

Teams im Mittelpunkt. Teamplanen wird dabei aufbauend auf Studie 1 als multidimensionales Konstrukt betrachtet.

Zunächst wird in dieser Studie der Stand der Forschung und ihre Relevanz dargelegt. Seit langem wird von einem positiven Zusammenhang zwischen Teamplanen und der Teamleistung auf theoretischer Ebene ausgegangen (z.B. Mumford et al., 2015; West, 2000). Dieser konnte bereits empirisch nachgewiesen werden (z.B. Fisher, 2014; Mehta et al., 2009). Dennoch sind die Antezedenzen des Teamplanens bisher vernachlässigt worden. Dabei wäre es angesichts der leistungssteigernden Wirkung von Teamplanen für Unternehmen wertvoll zu wissen, ob Teams auch aufgrund äußerer Umstände planen, um gegebenenfalls geeignete Maßnahmen (z.B. Teamtrainingsinterventionen) ergreifen zu können. Aufbauend auf der Ressourcenallokationstheorie (Norman & Bobrow, 1975), der Handlungsregulationstheorie (Hacker, 2005) und der Zielsetzungstheorie (Locke & Latham, 2002) wird angenommen, dass der Zeitdruck, die Aufgabenroutine und die Folgeschwere von Entscheidungen einen Einfluss auf das Planungsverhalten von Teams besitzen.

Zur Untersuchung dieser Hypothesen wird ein Policy-Capturing-Design (Aiman-Smith et al., 2002; Karren & Barringer, 2002) genutzt. Dabei bearbeiteten die Teilnehmer hypothetische Szenarien, in denen die Situationsmerkmale (Zeitdruck, Aufgabenroutine, Folgeschwere) experimentell auf zwei Stufen (hoch, niedrig) manipuliert wurden. Die sich aus allen Kombinationen ergebenden acht Szenarien wurden von Studierenden ($N = 81$) sowie von Arbeitnehmenden ($N = 101$) im Rahmen einer Onlinebefragung hinsichtlich der Planungsintention im Team bewertet. Die Auswertung erfolgte mithilfe von Hierarchisch Linearer Modellierung. Zusätzlich wurde die faktorielle Validität der multidimensionalen Skala mithilfe konfirmatorischer Faktoranalysen untersucht.

Die Ergebnisse zeigen, dass der Umfang des Teamplanens zunimmt, wenn wenig oder kein Zeitdruck besteht, wenn die Aufgaben nicht routinemäßig sind oder wenn eine hohe Fol-

genschwere besteht. Zudem konnte die Struktur der multidimensionalen Teamplanenskala weiter validiert werden. In der abschließenden Diskussion werden die Ergebnisse der Studie, Implikationen, Limitationen sowie zukünftiger Forschungsbedarf näher erläutert.

1.3.3 Kapitel 4: Studie 3

Während in Studie 1 und 2 der spezifische Prozess des Teamplanens untersucht wurde, rückt in Studie 3 die Abhängigkeit der verschiedenen Teamprozesse, ihre Dynamik und das sich daraus ergebende zeitliche Muster in den Fokus. Aufbauend auf dem Recurring Phase Model of Team Processes von Marks et al. (2001) wird in Studie 3 daher der Rhythmus der Teamarbeit betrachtet. Ziel der Studie ist es, den Rhythmus der Teamarbeit und die zentralen Annahmen von Marks et al. (2001) diesbezüglich erstmals empirisch zu untersuchen und zu überprüfen.

Zu Beginn der Studie erfolgt eine Einordnung in den aktuellen Forschungsstand. Als Ausgangspunkt einer Vielzahl von Studien zu den gerade aus Unternehmenssicht relevanten Teamprozessen diente in der Vergangenheit das Recurring Phase Model of Team Processes von Marks et al. (2001). Relevante Aspekte des Modells wie die Taxonomie der Teamprozesse konnten bereits metaanalytisch validiert werden (LePine et al., 2008). Darüber hinaus integrieren die Autoren jedoch auch eine zeitliche Perspektive, die in dem von ihnen postulierten Rhythmus der Teamarbeit berücksichtigt wird. Dieser wird als zyklische Abfolge von unterschiedlich langen Transitions- und Aktionsphasen (Cluster spezifischer Teamprozesse) beschrieben. Obwohl eine empirische Untersuchung des Rhythmus der Teamarbeit zum Verständnis der Funktionsweise von Teams und insbesondere hinsichtlich der Dynamik von Teamprozessen beitragen könnten, ist diese bislang nicht erfolgt.

Um den Rhythmus der Teamarbeit erstmals systematisch beschreiben und empirisch untersuchen zu können, wurde daher eigens eine vierstufige Methode entwickelt. Zu diesem Zweck wurden studentische Teams im Rahmen einer Laborstudie beim sequentiellen Bearbei-

ten einer kreativen Aufgabe und einer Konstruktionsaufgabe per Video beobachtet. Darauf aufbauend wurden Teamprozesse (Schritt 1) und Taskwork (Schritt 2) kodiert, da diese laut Marks et al. (2001) den Rhythmus der Teamarbeit determinieren. Anschließend wurden dann Transitions- und Aktionsphasen, definiert als Cluster von Transitions- oder Aktionsprozessen, mithilfe einer Gauß-Filterfunktion bestimmt (Schritt 3). Um unterschiedliche Rhythmen statistisch beschreiben zu können, wurde das Tempo des Rhythmus, sowie dessen Regelmäßigkeit, der Fokus des Rhythmus (Transition vs. Aktion) und dessen Variabilität bestimmt (Schritt 4). Mithilfe von Latenten Profilanalysen (Ferguson et al., 2020) wurden dann die Annahmen von Marks et al. (2001) überprüft, ob Teams verschiedene Rhythmustypen aufweisen, die Art des Rhythmus je nach Aufgabe variiert und mit der Teamleistung zusammenhängt.

Die Ergebnisse der Studie weisen darauf hin, dass drei verschiedene Typen des Rhythmus der Teamarbeit unterschieden werden können und zeigen, dass der Rhythmus von der Art der Aufgabe abhängig ist. Zudem zeigt sich bei der kreativen Aufgabe, dass ein Rhythmus mit wechselndem Fokus (Transition vs. Aktion) mit einer geringeren Teamleistung zusammenhängt. Die Studie liefert damit erstmals eine Methode zur Erfassung des Rhythmus der Teamarbeit sowie einige erste empirische Erkenntnisse. Abschließend werden die Ergebnisse, Limitationen und zukünftiger Forschungsbedarf diskutiert.

1.3.4 Kapitel 5: Gesamtdiskussion

Im letzten Kapitel der vorliegenden Dissertation werden die Ergebnisse der Kapitel 2, 3 und 4 zusammengefasst und in die bestehende Forschung eingeordnet. Anschließend erfolgt eine kritische Bewertung der vorliegenden Arbeit und Implikationen für die Forschung und Praxis werden übergreifend diskutiert. Es folgt eine abschließende Bemerkung.

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2 STUDIE 1

TEAM PLANNING:

A PROCESS-ORIENTED MODEL AND DEVELOPMENT AND
VALIDATION OF THREE SCALES

Oldeweme, M. & Konradt, U. (2021). *Team Planning: A Process-Oriented Model and Development and Validation of Three Scales*. [Manuscript submitted for publication]. Institute of Psychology, Kiel University.

2 STUDIE 1

2.1 Abstract

In this study we present a process model of team planning, which distinguishes the four processes of exploration, strategic planning, detailed planning, and prognosis. Based on this model, we developed and validated a 16-item multidimensional long-form scale, a 4-item one-dimensional short-form scale, and a single-item scale. Results from three samples with varying populations (total $N = 536$) and settings provide support for (a) the multidimensionality of the construct and the theorized structure of the scales, demonstrate (b) discriminant and convergent validity, and (c) predictive validity in terms of team performance. Our results also show respectable internal consistency for both multiple-item scales.

2.2 Introduction

The importance of planning for team outcomes and results has been highlighted in both theory (e.g., Carver & Scheier, 1998; Hacker, 2005; Mumford et al., 2015; West, 2000) and research (e.g., Fisher, 2014; Mehta et al., 2009; Weingart, 1992). Team planning is often used to describe a set of team processes that are based on behavior (e.g., Ilgen et al., 2005, Marks et al., 2001, Smith et al., 1990). Nevertheless, team planning has often been conceived as a broad and one-dimensional construct (e.g., Mehta et al., 2009; Weldon et al., 1991). This approach is beneficial in terms of simplicity and applicability, but one-dimensional scales might suffer from limited content validity and predictive power (Fisher, 2014). Therefore, research has begun to uncover the multifaceted nature of team planning using multidimensional scales (DeChurch & Haas, 2008; Fisher, 2014).

However, it is striking that the existing multidimensional scales hardly consider team planning processes that are often discussed in theory. For example, most planning models assume that planning begins with searching information (Frese et al., 2007), goal elaboration (Dörner, 2016) or scanning the environment (Mumford et al., 2001), but none of these processes are included in existing team planning scales. Consequently, there is no clear and unified understanding of the team planning process with its various elements, their antecedents, and consequences.

A possible reason for the lack of understanding of the team planning process is that a theory is not available that focuses exclusively on the behavioral processes involved and their different functions in terms of achieving goals. Existing theories on planning do not refer explicitly or exclusively to the team level (e.g., Dörner, 2016; Mumford et al., 2015) or are characterized by a focus on cognitive rather than behavioral processes (e.g., Mumford et al., 2015). Other theories focus on content-related aspects such as the timing of planning processes (Marks et al., 2001) or on what is being planned (Fisher, 2014). In addition, theories (Hacker, 2005; Dörner, 2016) include team processes that are generally thought of as team actions rather than

processes (Marks et al., 2001). Because of its descriptive approach, a process model would have an advantage over normative sequential planning models (e.g., Dörner, 2016; Mumford et al., 2015). A process model would imply neither a one-size-fits-all solution (i.e., a perfect sequence of planning processes) nor serial dependencies between the processes. However, it would enable to investigate the functionality of different team planning processes across various contexts and thus advance our understanding of the team planning process.

The main goal of the present research is to advance a process model of team planning, which depicts the planning processes in a comprehensive and differentiated way. Based on this model, we develop and validate a multidimensional scale to assess these team planning processes. However, time and cost are key considerations in practice and may prevent the use of long scales (e.g., Crawford et al., 2001; Woods & Hampson, 2005). As existing one-dimensional scales have often not been carefully validated (e.g., Mehta et al., 2009; Smith et al., 1990), another goal of this study is to develop and validate two short-form scales to capture team planning. To address these goals, we first define team planning and review existing planning models to derive a process model. Subsequently, we develop and test psychometrically a multidimensional long-form scale, a one-dimensional short-form scale, and a single-item scale. Finally, we investigate in a randomized controlled study whether the three scales can predict team performance and thus have predictive validity.

2.3 Theoretical Background

2.3.1 Definitions of Team planning

Previous research provides several definitions of team planning, which vary in terms of the scope and focus of the construct (e.g., Hackman & Moris, 1975; DeChurch & Haas, 2008; Mumford et al., 2001). In a widely used, domain-independent, definition by Steiner (1972), planning refers to a process of determining in advance what needs to be done, how it should be

done, and who should do what. Team planning is defined by Marks et al. (2001) as “development of alternative courses of action for mission accomplishment” (p. 365) and by McGrath (1984) as an activity “that requires the group to lay out a course of action by which it can attain an already chosen objective” (p. 127). These definitions stress the importance of developing alternative plans and of separating planning from the goal-setting process.

In this research, we conceive planning as a team-level process that can be distinguished from other team processes of coordination or goal setting (Marks et al., 2001; McGrath, 1984). Team members interact purposefully to determine what actions they could take and what action they will take to achieve their goal (Marks et al., 2001; McGrath, 1984). We therefore define team planning as a deliberate and interactive process of generating, selecting and elaborating future courses of action to attain task goals.

2.3.2 A Process Model of Team Planning

Researchers have already begun to differentiate between various sub-processes within the team planning process (e.g., Marks et al., 2001; Mumford et al., 2015). However, a process-oriented theory of team planning that focuses exclusively on the behavioral processes involved and their different functions in terms of achieving goals is missing. Consequently, a profound understanding of the team planning process is impaired. To advance a process model of team planning, we reviewed the literature, paying attention to theoretical models of planning as those of Mumford et al. (2001), Dörner (2016) and Hacker (2005).

In short, Mumford et al. (2015) link a multitude of cognitive processes to show the sequence of the various elements in the planning process. Due to its cognitive orientation and its applicability at individual, team, and organizational level, this model integrates processes in the planning process that are relevant, for example, at the individual level but not at a behavioral level of team processes (e.g., case activation). Besides, action regulation theory (Hacker, 2005; Volpert, 1982) considers basic cognitive (e.g., perception, planning, and thinking) and behavioral processes (i.e., actions and movements) that occur during goal-oriented behavior (for a

review, see Zacher & Frese, 2018). The model is not limited to the planning process but also reflects the general regulation of goal-directed behavior and has been applied to the team level (e.g., von Cranach, 1996). Dörner (2016) presents a similar phase model for the domain of complex problem solving. His model identifies five phases within the planning process but it includes processes that go beyond planning, such as controlled action. In addition, the model does not refer directly to teams.

Because an extensive review would go beyond the scope of this article, we focus in the following on the similarities between these models and include some repeated assumptions in the literature. This enables us to develop our model of team planning, setting out the various behavioral processes involved with their different functions. Also, by choosing a descriptive approach, we specify the composition of team planning. In addition, we do not assume sequential dependencies between the sub-processes and we consider the entire planning process in terms of all observable actions by team members that are part of this process. We have identified four relevant team planning processes namely *exploration*, *strategic planning*, *detail planning*, and *prognosis*.

First, we define exploration as the collection of information relevant to the task to be tackled. Exploration includes examining what is needed to achieve the particular goal and involves searching for information on the relevant boundary conditions that define the scope of the action. The process of exploration is based on Hacker's (2005) description of a phase of orientation about the task, possible ways of executing it, and boundary conditions for goal attainment. Similarly, Dörner (2016) describes phases of goal elaboration and scanning of the situation, while Mumford et al. (2015) also refer to scanning the situation as part of the team planning process. We deliberately do not include goal development in our model, as it is understood to be a separate team process and is therefore conceptually distinct from the planning process (McGrath, 1984).

Second, we distinguish strategic planning from detailed planning. We define strategic

planning as the generating and weighing up of different strategies and alternative actions to meet the objectives. The aim of this process is to establish a basic direction before a plan is refined and developed further. Detailed planning refers to the detailed elaboration and refinement of at least one strategy or course of action (cf. Hacker, 2005). This involves concrete and binding agreements on how various aspects of the task should be distributed, how time should be used, and, if necessary, how additional resources should be allocated. Detailed planning also includes the development of ‘if-then’ plans for specific situations. We have derived these two processes from several observations: Hacker (2005) proposed the generating of a plan or action program and the decision on the actual method of execution as relevant planning processes. Similarly, Dörner (2016) highlights a planning and decision-making phase in which concrete action plans are conceived as a combination of various actions. Mumford et al. (2015) also mention the identification of concrete action steps, their sequence, and the formulation of back-up plans. While Hacker distinguishes between a general plan and detailed steps for executing it, this distinction is not evident in the other models, which refer directly to the detailed level. However, the development of a broad action strategy and the detailed steps needed for execution are also explicitly discussed by Frese et al. (2007), as they are also in the cognitive model of planning (Hayes-Roth & Hayes-Roth, 1979).

Finally, we define prognosis as the examination of the selected course of action regarding its feasibility, effectiveness, and efficiency. Prognosis is often referred to as mental simulation, mental anticipation, or forecasting (e.g., Frese et al., 2007; Mumford et al., 2015) as part of the planning process. It involves going over the plan in one’s mind and checking for possible consequences and obstacles. Depending on the results, this process may lead to a multiple revision of the plan and can thus trigger strategic or detailed planning.

2.3.3 Measuring Team Planning

2.3.3.1 Factorial Validity and Psychometric Properties

In accordance with our process model, we developed a multidimensional long-form team planning scale. Besides having good psychometric properties, it is essential for any scale to be correlated with other theoretically related measures and to show factorial validity (DeVellis, 2017; Hinkin, 1998). We therefore hypothesized that:

Hypothesis 1: The multidimensional long-form scale of team planning is best conceptualized by having four processes: exploration, strategic planning, detailed planning, and prognosis.

In addition to a multidimensional long-form scale, we developed two short one-dimensional versions for three reasons. First, time and cost play a major role in practice. This can lead to more extensive instruments being used only partially or inventories for team diagnostics not being used at all (e.g., Crawford et al., 2001; Woods & Hampson, 2005). Second, short surveys are more acceptable to employees than long ones and help to reduce item and unit non-response (Rogelberg & Stanton, 2007). Third, studies on the emergence of team processes and their dynamics require a high data density (Kozlowski & Chao, 2018). In the context of intensive longitudinal studies, short scales are essential to minimize the workload for participants (Ohly et al., 2010). Research in organizational (Fisher et al., 2016) and management domains (Bergkvist & Rossiter, 2007) has even demonstrated that the content, construct, and predictive validity of single-item scales are not necessarily restricted compared to multiple-item scales. We therefore formulate the following research questions:

Research Question 1: Does a short-form team planning scale has sufficiently good psychometric characteristics?

Research Question 2: Does a single-item scale for team planning have sufficiently good psychometric characteristics?

2.3.3.2 Convergent and Predictive Validity

To determine construct validity, we used a nomological network (cf. Cronbach & Meehl, 1955) of constructs. On a theoretical level, these constructs should be correlated (convergent validity) with team planning. Although our planning model differs from other models and scales, it will overlap with previous measures of team planning. To examine this, we used the measure developed by DeChurch and Haas (2008), which is based on the taxonomy of team processes of Marks et al. (2001) and is well validated and broad in scope. In this measure team planning is divided into the dimensions of deliberate planning, contingency planning, and reactive adjustment. Positive correlations are expected between all dimensions.

Hypothesis 2: There is a positive correlation between the planning scale developed by DeChurch and Haas (2008) and (a) the multidimensional long-form scale, (b) the one-dimensional short-form scale, and (c) the one-dimensional single-item scale.

To further examine the convergent validity, we used psychological constructs in the team context that were closely related to team planning, including reflexivity. Reflexivity is the extent to which teams reflect on and adapt to their strategies, behavior, and environment (West, 2000). Because West conceptualized team reflexivity as a continuous circle of reflection, planning, and adaptation, it can be assumed that there is a positive relationship between planning and reflexivity and reflection. Providing a more fine-grained operationalization of reflexivity, Konradt et al. (2015) defined reflection as a “series of behaviors accumulating and evaluating information through observations of the self, the own team or the environment” (p. 154). We hypothesized that planning is positively related to reflexivity and reflection:

Hypothesis 3: There is a positive correlation between reflexivity and (a) the multidimensional long-form scale, (b) the one-dimensional short-form scale, and (c) the one-dimensional single-item scale.

Hypothesis 4: There is a positive correlation between reflection and (a) the multidimensional long-form scale, (b) the one-dimensional short-form scale, and (c) the one-

dimensional single-item scale.

Information sharing refers to the extent to which information within a team is exchanged between members (De Dreu, 2007). Mumford et al. (2015) assumed that the exchange of information has a positive influence on team planning. Accordingly, team members should strive to share task-related information so that they can plan with each other on this basis. Empirical evidence shows there is a positive correlation between information sharing and reflexivity or reflection (De Dreu, 2007; Otte et al., 2016). Because both planning and reflection are defined as part of reflexivity, we hypothesized that planning will also be positively related to the exchange of information:

Hypothesis 5: There is a positive correlation between information sharing and (a) the multidimensional long-form scale, (b) the one-dimensional short-form scale, and (c) the one-dimensional single-item scale.

Regarding predictive validity, a positive relationship between team planning and team performance is assumed in several theories (e.g., Hacker, 2005; West, 2000; Mumford et al., 2015). Team performance is the result of the team members' joint efforts to attain a common goal (LePine, 2003), and empirical studies (e.g., Fisher, 2014; Mehta et al., 2009; Weingart, 1992) have demonstrated moderate-to-high positive correlations between the two. Consequently, we expect a positive correlation between team planning and team performance:

Hypothesis 6: There is a positive correlation between team performance and (a) the multidimensional long-form scale, (b) the one-dimensional short-form scale, and (c) the one-dimensional single-item scale.

2.4 Scale Development

Following the guidelines established by Hinkin (1998) and DeVellis (2017) we used a systematic multi-step approach to develop each of the three scales for team planning. We first generated an item pool and presented a promising set of items to two different and consecutive

samples to examine the psychometric properties of the new scales (Research Questions 1 and 2). Based on the data obtained from these two samples, we then reduced the number of items, conducted confirmatory factor analyses (CFA) to investigate the construct validity (Hypothesis 1), examined the convergent validity using two samples (Hypotheses 2–5), and checked the predictive validity of the new scales using an additional sample (Hypothesis 6).

2.4.1 Study 1: Item Generation, Construct Validity, and the Nomological Network

To generate an item pool, three experts in the field of team planning (including one of the authors) initially generated items independently by creating propositions based on the definition of the four planning dimensions and the existing team planning definitions (83 items). They also systematically reviewed the present scales for team planning (DeChurch & Haas, 2008; Fisher, 2014; van der Kleij et al., 2009; Mehta et al., 2009; Smith et al., 1990) to reassign items where possible either to the proposed four factors of the long-form scale or to a global planning construct for the one-dimensional scale (26 items). This procedure was complemented by 12 explorative interviews with master students and employees, who were asked to formulate questions that could be used to examine team planning. We transcribed the interviews and the experts assigned items to the planning dimension (97 items) or the global planning construct (15 items). Subsequently, six experts (including the authors) rated, reduced, and adapted the set of items in terms of intelligibility, duplication, and whether they adequately captured the specific dimension. We also sought to avoid formulations that would indicate cognitive processes (e.g., “we thought” or “we considered”) or that would not indicate clearly observable behavior by a team member. In addition, items were not allowed to be content-specific so that the scale could be used with different users and in different settings. Consistent with suggestions made by van Mierlo et al. (2009), we used a referent-shift consensus model (Chan, 1998) and therefore asked the team members to evaluate the planning in their team (“we”). This procedure resulted in a set of 29 items for the long-form scale (each dimension was represented by seven

to eight items), five items for the short-form scale, and one item for the single-item scale. Further, the experts developed and agreed upon short descriptions of each construct (see Table 2.1). The answer format was a five-point Likert-type scale ranging from 1 (*not at all*) to 5 (*to a very great extent*). Finally, we used semi-structured cognitive interviews (Fisher & Geiselman, 1992) with 20 master students and employees to examine whether the items and response format were clear, unambiguous, and precisely formulated. Any ambiguous items were subsequently reformulated by the team of experts.¹

2.4.1.1 Method

2.4.1.1.1 Participants and Procedure

To examine the construct and convergent validity, we recruited 206 undergraduate students (Sample A: mean age = 23.30, $SD = 5.24$, 73.66% female, 42.93% psychology students) using mailing lists, social networks, and personal contacts. In addition, we recruited a second sample of 210 employees (Sample B: mean age = 38.19, $SD = 13.80$, 61.90% female) from different occupations (e.g., teacher, pharmacist, banker), using our personal contacts in various companies, mailing lists, and social networks. The ratings participants gave in response to a question on teamwork (“I regularly work in a team”) indicated that they had considerable teamwork experience (Sample A: $M = 3.88$, $SD = 1.02$; Sample B: $M = 4.14$, $SD = 1.06$); a five-point Likert scale (1 = *strongly disagree* to 5 = *strongly agree*) was used for this item. Participants either received a course credit (Sample A) or had the opportunity to win a 20-Euro voucher (Sample B). Data were gathered using a 20-minute online questionnaire in which participants first recalled an episode of teamwork undertaken by the team they currently worked in or had previously worked in. This should trigger more vivid memories of a specific former episode, to which all answers should refer. Then, participants were asked to answer the items on each scale. We assured participants that there were no right or wrong answers and presented

¹ The complete list of items can be obtained from the first author.

Table 2.1

Standardized Item Loadings of the Team Planning Scales, with Standard Errors in Parentheses (Separate CFAs for the Long-Form and Short-Form Scales)

Dimension	No.	Item wording	Sample A	Sample B	Sample C
Exploration (long-form)		<i>The following questions are about how intensively you and your teammates have dealt with important information for your team planning</i>			
	1	We brought to mind the specifications we need to meet	.60 (.06)	.59 (.08)	.65 (.10)
	2	We discussed what might be necessary to attain our goal	.66 (.06)	.64 (.05)	.54 (.07)
	3	We informed ourselves about the conditions we need to bear in mind	.67 (.06)	.48 (.08)	.75 (.08)
	4	We brought to mind what we need to pay attention to	.68 (.06)	.81 (.05)	.85 (.05)
Strategic planning (long-form)		<i>The following questions are about how intensively you and your teammates have developed strategies and alternatives in the team to attain your goal</i>			
	1	We collected ideas on how to generally proceed	.62 (.05)	.56 (.06)	.62 (.09)
	2	We exchanged views on what we could do	.68 (.05)	.56 (.06)	.70 (.06)
	3	We discussed different possibilities regarding how to attain our goal	.79 (.05)	.76 (.04)	.85 (.05)
	4	We talked about different approaches	.75 (.04)	.84 (.04)	.86 (.05)
Detailed planning (long-form)		<i>The following questions are about how extensively you and your teammates have elaborated your plans in the team</i>			
	1	We made clear agreements	.72 (.04)	.68 (.05)	.88 (.03)
	2	We planned the separate steps of our approach	.68 (.05)	.67 (.06)	.80 (.04)
	3	We determined the details of our approach	.81 (.04)	.76 (.05)	.84 (.04)
	4	We discussed in detail how we want to proceed	.85 (.03)	.77 (.04)	.82 (.04)

(continued on next page)

Table 2.1 (continued)

Dimension	No.	Item wording	Sample A	Sample B	Sample C
Prognosis (long-form)		<i>The following questions are about how intensively you and your teammates have reflected your plans in advance in the team</i>			
	1	We discussed whether there was any objection to our plan	.74 (.05)	.77 (.04)	.75 (.05)
	2	We discussed whether our plan is realizable	.75 (.04)	.77 (.04)	.75 (.05)
	3	We discussed whether our plan will lead to our goal	.73 (.04)	.72 (.05)	.84 (.04)
	4	We talked about whether there might be difficulties in realizing our plan	.68 (.05)	.71 (.05)	.76 (.06)
Short-form		<i>The following questions are about how intensively you and your teammates have planned together in the team</i>			
	1	We have planned how we are going to proceed	.89 (.03)	.81 (.03)	.91 (.03)
	2	We have planned what we want to do to attain our goal	.84 (.03)	.90 (.03)	.84 (.05)
	3	We have collected ideas on how we could proceed	.63 (.05)	.66 (.05)	.54 (.08)
	4	We have agreed on how we want to implement the plan	.78 (.03)	.72 (.04)	.84 (.04)
Single item ^a		We have planned in detail how we intend to attain our goal	–	–	–

Notes. $N = 206$ (Sample A); $n = 210$ (Sample B); $n = 120$ (Sample C). Introduction sentences of the scales are shown in italics. Response scale: 1 =

not at all; 2 = very little; 3 = to some extent; 4 = to a great extent; 5 = to a very great extent. All loadings were significant at $p < .001$.

^a Factor loadings are missing because no CFA can be conducted for the single-item scale.

the scales and the items within each scale in a random order (with the exception of the team planning scales, which were always presented at the beginning) to prevent possible sequence effects or common method bias (Podsakoff et al., 2003).

2.4.1.1.2 Measures

All measures that were not available in German were translated following Brislin's (1970) forward-backward procedure.

Team Planning. Team planning was assessed using the long-form scale (29 items for Sample A and 17 items for Sample B), the short-form scale (5 items for Samples A and B), and the single-item scale. The number of items used with each of the two samples differed due to the consecutive procedure of item reduction (see below). For the multidimensional long-form scale and short-form scale, participants were given short descriptions of the underlying constructs to make it easier for them to comprehend them (see Table 2.1).

Also, the nine-item scale developed by DeChurch and Haas (2008) was used to assess team planning. The scale measures three dimensions of team planning: deliberate planning, contingency planning, and reactive adjustment. Internal consistency was sufficient (Cronbach's $\alpha \geq .64$), except for the dimension of reactive adjustment ($\alpha = .45$ for sample A; $\alpha = .40$ for sample B), which was below acceptable limits of reliability (Nunnally & Bernstein, 1994). As there are limited grounds for adopting such heuristics (Pedhazur & Schmelkin, 1991) and the low level of consistency can be attributed to the small number of items (Cortina, 1993), we refrain from eliminating them. The response format used for all planning scales was a five-point Likert scale ranging from 1 (*not at all*) to 5 (*to a very great extent*).

Team Reflexivity. Team reflexivity was measured by Van Dick and West's (2005) German adaptation of West's (2000) team reflexivity scale using a five-point Likert-scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). A sample item is: "We often reviewed the methods we used to get the job done." The internal consistency of the eight-item scale was very

good for both samples (Cronbach's $\alpha > .80$).

Team Reflection. The 16-item scale by Otte et al. (2016) was employed to measure team reflection, using a five-point Likert-scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The scale included quality and quantity aspects of information seeking and information evaluation. Reliability for all dimensions in both samples was respectable to very good (all Cronbach's $\alpha > .79$).

Information Sharing. Information sharing was measured by the German adaptation by Otte et al. (2016) of the five-item information sharing scale by De Dreu's (2007); a five-point Likert-scale was used, ranging from 1 (*rarely*) to 5 (*very often*). A sample item is "Members of my team inform each other about work-related issues." Reliability was respectable, with values being above a Cronbach's α of .69.

2.4.1.2 Data Analysis

For both samples, we undertook a stepwise analysis (see DeVellis, 2017; Hinkin, 1998) of the long-form, short-form, and single-item scales. First, we reduced the item pool and checked the construct validity for the long-form and short-form scales. We then looked for internal consistencies and checked the convergent validity of the long-form, short-form, and single-item scales.

To reduce the item pool of the long-form and short-form scales, we initially evaluated each item based on Sample A. Next, we used Sample B to re-evaluate the remaining items and replicate our findings. We performed Kolmogorov–Smirnov (KS) tests to check whether the scores for each item were normally distributed (Wilcox, 1997). Then, we considered the degree of separation and the item difficulty and excluded items with values that varied widely from the suggested limits (Hogan, 2013). Separate CFAs for each of the four dimensions of the long-form scale and for the short-form scale were conducted using MPlus 8.3 (Muthén & Muthén, 1998–2017). Item with factor loadings below .5, or with noticeable modification indices that were not explainable by theoretical assumptions (see MacCallum, 1986), were deleted. We

maximized content validity by keeping as much variance as possible regarding the content of the items.

To check the construct validity of the long-form scale, we first ran a multigroup CFA across both samples with unconstrained parameters using the robust mean-adjusted maximum likelihood test (MLR) estimator (Satorra & Bentler, 1994), as indicated by a significant KS test. The hypothesized four-factor model was compared to a three-factor model (i.e., exploration, planning, and prognosis) and a one-factor model. To evaluate structural equation models, we followed the guidelines provided by Hu and Bentler (1999) using the Comparative Fit Index (CFI; ≥ 0.95 good, ≥ 0.90 acceptable), the Tucker–Lewis index (TLI; ≥ 0.95 good, ≥ 0.90 acceptable), the root-mean-square error of approximation (RMSEA; $\leq .06$ good), and the standardized root-mean-square residual (SRMR; $\leq .08$ good). To compare the goodness of fit of the nested models, we used the scaled difference chi-square test statistic, because the normal approach yields incorrect results if an MLR estimator is used (Bryant & Satorra, 2012). Standardized factor loadings were interpreted using Comrey and Lee’s (1992) recommendations ($\lambda > .71$ = excellent; $\lambda > .63$ = very good; $\lambda > .55$ = good; $\lambda > .45$ = fair; $\lambda < .32$ = poor). Factor correlations were used to examine discriminant validity between each dimension of the scale, which should not be greater than .85 (cf. Cohen et al., 2003). To check the construct validity of the short-form scale, we also used the robust MLR estimator (Satorra & Bentler, 1994) to run a multigroup CFA across both samples with unconstrained parameters. In addition, we checked for measurement invariance to ensure that the long-form and short-form scales were measuring the same construct across both samples, which provides further evidence of validity (cf. Putnick & Bornstein, 2016). Specifically, we followed the guidelines of Widaman and Reiss (1997) and compared the fit values of the nested models (all parameters are freely estimated in all of the samples but the underlying measurement structure is held constant across samples), the metric models (factor loadings are invariant), and the scalar models (invariance of factor loadings and item intercepts).

To check the internal consistencies of each scale, we used Cronbach's alpha. The reliability of the single-item scale was calculated using the correction for attenuation formula and the communality of the single-item scale obtained in a multiple-item factor analysis (cf. Wanous & Reichers, 1996).² The communality of the single-item scale was determined by correlating this scale with the long-form scale (Dolbier et al., 2005).

We checked the convergent validity of each scale using bivariate correlation coefficients. To do this we aggregated the two samples, because the test for measurement invariance revealed there was metric invariance, indicating that the regression coefficients of Sample A and B were comparable.³

2.4.1.3 Results and Discussion

The process of item reduction resulted in a final set of 16 items for the long-form and four items for the short-form scale. Summary statistics are presented in Table 2.2. The results of the multigroup CFA regarding construct validity are shown in Table 2.3. Hypothesis 1, which predicted that the long-form team planning scale is best conceptualized by having four processes, was supported. The results of the CFA indicated that the four-factor model fitted the data reasonably well ($\chi^2 = 261.69$, $df = 96$, $p < .01$, RMSEA = .04 (90% CI [.02, .05]), SRMR = .05, CFI = .97, TLI = .97), compared to the three- and the one-factor models, where the fit was in each case well outside the acceptable range. For the long-form scale, the factor loadings in both samples ranged from .48 (fair) to .85 (excellent). Factor correlations between all dimensions of the long-form scale indicated satisfactory discriminant validity ranging between .18 and .58, which is below the critical limit of .85 (cf. Cohen et al., 2003). For the short-form scale the goodness-of-fit indices indicated that the one-factor model fitted the data reasonably well ($\chi^2 = 31.93$, $df = 7$, $p < .001$, RMSEA = .13 (90% CI [.09, .18]), SRMR = .05, CFI = .95, TLI

² We assume a true correlation between the single-item and the long-form scale of $\hat{r}_{xy} = .95$.

³ Results of separate analyses are broadly similar across both samples but differ on one point: In Sample B the correlation between prognosis and information sharing was not significant.

Table 2.2*Correlations and Descriptive Statistics for Study Variables of Aggregated Data of Samples A and B*

Measure	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Exploration	4.16	0.65	(.74)														
2. Strategic planning	3.77	0.82	.38	(.80)													
3. Detailed planning	3.60	0.89	.50	.49	(.84)												
4. Prognosis	3.48	0.92	.39	.48	.41	(.83)											
5. Short-form scale	3.96	0.80	.51	.53	.63	.41	(.86)										
6. Single-item scale ^a	3.51	1.04	.42	.39	.64	.33	.64	(.53/ .59) ^a									
7. Deliberate planning	3.69	0.81	.40	.27	.42	.30	.51	.50	(.64)								
8. Contingency planning	2.54	1.03	.33	.47	.37	.46	.36	.33	.38	(.82)							
9. Reactive adjustment	3.44	0.79	.12	.20	.21	.20	.29	.17	.26	.36	(.42)						
10. Quantity of information search	3.09	0.93	.35	.36	.39	.39	.40	.45	.42	.44	.29	(.81)					
11. Quality of information search	2.91	1.02	.33	.42	.40	.44	.39	.46	.44	.48	.32	.78	(.88)				
12. Quantity of information evaluation	3.12	0.96	.28	.37	.37	.35	.35	.42	.37	.36	.24	.62	.65	(.86)			
13. Quality of information evaluation	2.89	0.99	.36	.38	.39	.38	.40	.47	.43	.40	.22	.66	.72	.79	(.89)		
14. Reflexivity	2.73	0.80	.29	.43	.36	.42	.37	.37	.41	.50	.37	.61	.61	.58	.60	(.82)	
15. Information sharing	3.65	0.64	.39	.39	.43	.29	.50	.43	.43	.36	.31	.42	.36	.37	.36	.42	(.73)

Notes. $N = 416$. Reliability coefficients on the diagonal. All correlations are significant ($p < .05$; two-tailed).

^a Reliability estimate are based on correction for attenuation formula and communality.

Table 2.3*Model Fit Indices of the Long-Form and Short-Form Scales of Aggregated Data of Samples A and B*

Model	Model fit						Model difference			
	χ^2	<i>df</i>	<i>p</i>	CFI	TLI	RMSEA [90% CI]	SRMR	ΔM	Δdf	$\Delta \chi^2$
<i>Long-form</i>										
<i>Factorial validity</i>										
Four-Factor	261.69	96	.007	.97	.97	.04 [.02, .05]	.05	4 vs. 3	7	232.09*
Three-Factor	501.57	89	< .001	.86	.84	.08 [.07, .09]	.08	3 vs. 1	8	256.51*
One-Factor	858.70	81	< .001	.68	.66	.12 [.11, .13]	.10			
<i>Factorial invariance</i>										
Configural (C)	242.28	196	.014	.98	.97	.03 [.02, .05]	.049	C vs. M	12	5.17
Metric (M)	248.49	208	.029	.98	.98	.03 [.01, .04]	.052	M vs. S	24	27.38
Scalar (S)	269.93	220	.012	.98	.97	.03 [.02, .05]	.054	S vs. C	12	22.58*
<i>Short-form</i>										
<i>Factorial validity</i>										
One-Factor	31.93	7	< .001	.95	.91	.13 [.09, .18]	.05			
<i>Factorial invariance</i>										
Configural (C)	17.76	4	< .001	.97	.91	.13 [.07, .19]	.03	C vs. M	3	6.26
Metric (M)	25.24	7	< .001	.94	.93	.11 [.08, .15]	.10	M vs. S	6	17.69*
Scalar (S)	36.90	10	< .001	.94	.93	.11 [.08, .15]	.10	S vs. C	3	11.93*

Notes. *N* = 416. CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root-mean-square error of approximation; SRMR =

standardized root-mean-square residual. * *p* < .05.

=.91; Research Question 1), with the exception of the RMSEA, which did not fall within the recommended range. The RMSEA value does not disconfirm our hypothesized model, because the RMSEA has been found to be problematic and potentially misleading in models with small degrees of freedom (Kenny et al., 2015). Factor loadings in both samples ranged between .63 (good) and .90 (excellent). The results for measurement invariance are also shown in Table 2.3. There was a statistically significant difference between the scalar and the metric model for the long-form scale ($\Delta\chi^2 = 22.58$, $\Delta df = 12$, $p = .03$), indicating metric invariance. There was also a statistically significant difference between the scalar and the metric model ($\Delta\chi^2 = 17.69$, $\Delta df = 6$, $p = .007$) and the scalar and the configural model ($\Delta\chi^2 = 11.93$, $\Delta df = 3$, $p = .008$) for the short-form scale, also indicating metric invariance.

The results showed that the answer to Research Question 1 (whether the new short-form scale has sufficient psychometric characteristics) was yes (see Table 2.3): The internal consistency estimates were respectable to very good for both samples for the long-form ($\alpha = .73$ to $.86$) and the short-form scale ($\alpha = .86$). However, in terms of Research Question 2 (whether the psychometric characteristics of the single-item scale are adequate), the reliability estimates of the single-item scale ranged between .39 to .66, and these values are below the level normally considered acceptable (Nunnally & Bernstein, 1994).

The results for convergent validity (Hypotheses 2–6) are displayed in Table 2.2. Hypotheses 2a–c, which predicted that there would be a positive relationship between the new team planning scales and the three dimensions of DeChurch and Haas's (2008) team planning scale, were supported. All correlations for the long-form scale were statistically significant and positive (exploration: $r = .12$ to $.40$; strategic planning: $r = .20$ to $.47$; detailed planning: $r = .21$ to $.42$; prognosis: $r = .20$ to $.46$). For the short-form scale, correlations ranged between .29 for reactive adjustment and .51 for deliberate planning. For the single-item scale, correlations ranged between .17 for reactive adjustment and .50 for deliberate planning (all $p < .05$). Hypotheses 3a–c predicted there would be a positive relationship between the three planning scales

and West's reflexivity scale (2000). In support of Hypotheses 3a–c, correlations for the long-form scale ranged from .29 to .42; for the short-form scale they were .37 and for the single-item scale .37 (all $p < .001$). Hypotheses 4a–c assumed there would be a positive relationship between the new team planning scales and reflection, and this is supported by our data. All correlations for the long-form scale were significant and positive (exploration: $r = .28$ to $.36$; strategic planning: $r = .36$ to $.42$; detailed planning: $r = .37$ to $.40$; prognosis: $r = .38$ to $.44$). For the short-form scale, correlations ranged between .35 (quantity of information evaluation) and .40 (quality of information evaluation). For the single-item scale, correlations ranged between .42 (quantity of information evaluation) and .47 (quality of information evaluation) (all $p < .001$). Consistent with Hypotheses 5a–c, there were found to be positive relationships between the new team planning scales and information sharing. Moderate positive correlations were found for the long-form scale ($r = .29$ to $.43$); the correlations for the short-form scale and the single-item scale were .50 and .43 respectively (all $p < .01$).

Conclusively, the internal consistency and the CFA results observed for the long-form and short-form team planning scales provide clear evidence that both scales are psychometrically sound. Moreover, these results were robust across different samples, which is an important requirement for use in a broad range of applications. However, the results for the single-item scale indicate unacceptable reliability according to conventional criteria (Nunnally & Bernstein, 1994) but researchers (e.g., Fleeson, 2001; Nunnally, 1978) have argued that reliabilities above .50 are still meaningful and can be sufficient at an early stage of research. Similarly, Fisher et al. (2016) claimed that a reliability coefficient above .50 indicates more signal than noise, because it represents the proportion of the total variance that can be attributed to true score rather than error. We therefore deem the reliability of the single-item scale to be acceptable at this stage in the research. Furthermore, we established that there was metric measurement invariance for the long- and short-form scales, which indicates that each item contributes to the latent construct to a similar degree across different samples. Importantly, the moderate positive factor

correlations for the dimensions of the long-form scale indicate that it has sufficient divergent validity. This corroborates the theoretical assumptions about the structure and multidimensional nature of team planning proposed by our model. All the hypotheses relating to the nomological network were supported empirically, indicating good convergent validity. Admittedly, we relied exclusively on self-reported data, which may lead to common method biases. However, we used well-validated scales—with the exception of the scales to be developed—which showed overall good reliability values in the present study, so there is unlikely to be substantial common method bias (Conway & Lance, 2010). In addition, the experimental design we used was intended to try and prevent this form of bias (randomized presentation of the scales and instruction that there is no right answer; Podsakoff et al., 2003).

2.4.2 Study 2: Team Planning and Predictive Validity

The purpose of Study 2 was to validate the findings regarding the factorial validity of Study 1 using a different context and sample. In addition, we examined the relationship between team planning and team performance (Hypotheses 7a–c). For this purpose, we used a randomized controlled laboratory study to assess team performance in an objective manner and to overcome possible common method bias concerns while also controlling for other factors that might affect planning behavior.

2.4.2.1 Method

2.4.2.1.1 Participants and Procedure

We used mailing lists, social networks, notice boards, and personal contacts to recruit 120 undergraduate students of various programs (Sample C: mean age = 21.16, $SD = 2.99$, 81% female), whom we randomly assigned to 40 three-person teams. Teams took part in a modified version of the tower-building task (Goldberg & Maccoby, 1965), which allowed us to investigate their interaction and performance. This task has been used successfully in group experiments (e.g., Dirks, 1999) and we piloted it on five dyadic teams for validity purposes.

At the beginning, the teams were given written instructions describing the task of building a tower together. They were asked to build the tallest tower they could with the materials provided and to do so in the shortest possible time. The teams had money at their disposal to buy various materials, such as paper, building blocks, or straws to construct the tower. To make the paradigm more realistic, additional requirements had to be considered (e.g., certain materials had to be used, and the quantity of other materials was limited). We warned the teams that penalty points could be incurred for non-compliance with the rules. The building time was limited to seven minutes, which was found in the pre-study to be sufficient for high-fidelity towers to be built. The test room was divided into two zones: a meeting zone (for planning) and a construction zone (for assembling), made obvious by a line on the floor. Participants were instructed that as soon as a team member entered the construction zone, the seven-minute timer would start to count down, but that it would stop when no team member was in that zone. The team members were able to enter the construction zone as many times as needed. To distinguish planning from coordination (Chang et al., 2017), verbal communication was not allowed in the construction zone. The experiment ended when the team had finished the tower or the time had expired. Participants then completed the questionnaire, as described in the following section.

2.4.2.1.2 Measures

Team Planning. To measure team planning we used the 16-item long-form scale, the four-item short-form scale, and the single-item scale. As shown in Table 2.4, the interrater agreement $r^*_{wg(j)}$ values (Lindell et al., 1999) were above the required threshold (Smith-Crowe et al., 2014), which allowed us to aggregate answers to the team level. The long-form scale showed a respectable to very good internal consistency, with Cronbach's α ranging between .79 and .90. The short-form scale showed an internal consistency of .91, and the estimation of reliability for the single-item scale ranged between .53 (for attenuation formula) and .58 (for communality).

Table 2.4

*Means, Standard Deviations (SD), $r^*_{wg(j)}$ Agreement Indices, and Correlations of Study 2*

Measure	$M (SD)$	$r^*_{wg(j)}$	1	2	3	4	5	6	7
1. Team performance ^a	0.00 (0.47)	–	–						
2. Exploration	4.32 (0.45)	.78	.34	(.79)					
3. Strategic planning	4.27 (0.46)	.76	.47	.58	(.84)				
4. Detailed planning	3.95 (0.61)	.73	.41	.55	.49	(.90)			
5. Prognosis	3.55 (0.56)	.66	.50	.52	.57	.64	(.86)		
6. Short-form scale	4.39 (0.48)	.80	.35	.66	.63	.76	.60	(.91)	
7. Single-item scale	3.97 (0.55)	.69	.27	.51	.53	.77	.66	.80	(.53/ .58)

Notes. $N = 40$ teams. Reliability coefficients on the diagonal. All correlations are significant ($p < .05$; one-tailed).

^a z -standardized.

Team Performance. We assessed team performance using four indicators: tower height, tower stability, time taken, and penalty points. Tower height was measured in centimeters ($M = 70.33$, $SD = 36.84$), tower stability was the maximum force in grams with which the tower could be stressed without falling over when pulled at vertically ($M = 708.88$, $SD = 941.65$), and time taken was measured in seconds ($M = 2129.20$, $SD = 637.63$). Penalty points for rule violations were assessed by the experimenter ($M = 16.51$, $SD = 23.86$). All indicators were z -standardized (time and penalty points were reversed) and then averaged to give a team performance score ($SD = 0.47$, range: -1.03 to 1.32).

2.4.2.2 Data Analysis

Before testing the hypotheses, we re-examined the factorial validity of the long- and short-form scales. Hereto, we ran a CFA using again the robust mean-adjusted maximum likelihood test (MLR) estimator (Satorra & Bentler, 1994), as indicated by a significant KS test. To check the predictive validity we used bivariate correlation coefficients.

2.4.2.3 Results and Discussion

Means, standard deviations, interrater agreement, reliability values, and bivariate correlations are shown in Table 2.4 for all planning scales. The CFA of the hypothesized measurement model of the long-form scale ($\chi^2 = 141.35$, $df = 120$, $p < .001$, RMSEA = .06 (90% CI [.04,.08]), SRMR = .06, CFI = .95, TLI = .94) as well as for the short-form scale ($\chi^2 = 0.96$, $df = 2$, $p = ns.$, RMSEA = .00 (90% CI [.00, .15]), SRMR = .01, CFI = 1.00, TLI = 1.00) showed a good fit. All factor loadings were good to excellent (range: .54 to .91; see Table 2.1). Moreover, the results support Hypothesis 6a–c, which predicted that all three team planning scales would be positively related to team performance ($r = .34$ to $.50$, $p < .05$; $r = .35$, $p < .05$; and r

= .27, $p < .05$) for the long-form, short-form, and single-item scale respectively. The correlations coefficients did not decline significantly with scale length.⁴

Conclusively, the results provide clear support for the psychometric quality of the long-form and short-form scales and indicate that they have their predictive validity for team performance. However, team members' self-reported planning data may be influenced by their performance, as teams that knew they had performed well may have indicated that they had undertaken more planning (Frese et al., 2007). This explanation is contradicted by the fact that the teams did not receive feedback on their performance (i.e., height, stability, penalty points) until after they had completed the questionnaires and they were at no time able to compare their performance with that of other teams. Nevertheless, future research should seek to expand on the current findings by providing more convincing evidence on predictive and causal relationships and also by using unobtrusive methods (Ostrov & Hart, 2013).

Again, analyses for the single-item scale show that the internal consistency was below .70 but above .50, thus indicating meaningful reliability (cf. Fleeson, 2001). Importantly, the estimates were also very similar across field and laboratory settings, thereby reinforcing the results from Study 1.

2.4.3 General Discussion

The present study extends previous research on team planning in four meaningful ways. First, we proposed a process model of team planning that can be applied to a variety of contexts. Second, we developed a multidimensional scale that captures four function-oriented processes of team planning and that has been shown to be reliable and valid across three different samples and contexts. Third, we developed short-form and single-item scales of team planning, which

⁴ We also controlled for spatial skills, which might potentially be confounded with performance. The effects remained unchanged when the control variable spatial thinking was included, though that is not reported here for reasons of space.

showed good to adequate psychometric quality in terms of reliability and construct validity. Fourth, we provided evidence that each scale predicted team performance.

Drawing on existing theories (Dörner, 2016; Hacker, 2005; Mumford et al., 2015), we developed a theoretical model of team planning that identifies four distinct processes of exploration, strategic planning, detailed planning, and prognosis. The results of our study corroborate our theoretical assumptions about the structure. Our model allows team planning processes to be described in more detail than was possible using previous approaches (e.g., Mumford et al., 2015), and enables focal points and patterns of team planning to be identified (cf. Kennedy & McComb, 2014; Otte et al., 2018). A team planning focus can be determined by analyzing the characteristics and duration of the individual planning processes (e.g., the extent of exploration), whereas a team planning pattern can be described as a sequence of different planning processes, each of a different intensity and duration (cf. Marks et al., 2001). Thus, each team might have its own planning profile, allowing it to be distinguished more clearly from other teams and enabling more accurate diagnosis and targeted interventions.

Our model can also be integrated into other established theories of teamwork, thereby enhancing theory and allowing the development of more elaborate hypotheses. For example, West's work on reflexivity (2000) would benefit from a detailed representation and modelling of the different team planning processes. Differentiating between the team planning processes allows various types of reflexive behavior to be identified, which may be more or less beneficial for team performance (cf. Konradt et al., 2015). This makes possible a more differentiated diagnosis of teams that have not drawn any benefits from reflexivity or that may even have experienced adverse effects as a result (e.g., De Dreu, 2002, 2007).

The results of this study also demonstrated that the long-form scale of team planning had sound psychometric properties in terms of reliability, factorial validity, and convergent validity. These findings were robust across three different samples, which is an important requirement if the scale is to be suitable for use in a broad range of applications (Hinkin, 1998).

The moderate factor correlations between the planning dimensions of the long-form scale also indicate that these have sufficient discriminant validity and this generally supports the notion that team planning is multidimensional. The results from a forthcoming experimental study by Oldeweme et al. (2021) provide additional evidence of validation. The authors used the long-form scale to examine the effects of situational factors on team planning and demonstrated additional positive findings regarding reliability and factorial validity and also moderate factor correlations.

The findings of the current study also extend previous research by providing two short-form versions of the longer team planning scale, designed to improve cost-effectiveness and practicality (Woods & Hampson, 2005). Our findings suggest that both of the short-form scales we developed have sufficient construct and predictive validity. The multiple-item short-form scale showed very good reliability across all three samples. It allows team planning to be studied in contexts where the long-form scale cannot be used without negative side effects (e.g., requiring too much work of participants). This is the case, for example, when there are issues about time and cost (e.g., Crawford et al., 2001; Woods & Hampson, 2005) or about generating a high density of data (Ohly et al., 2010). Furthermore, the internal consistency of our one-item scale is sufficient at least at an early stage of research (Fleeson, 2001; Nunnally, 1978). Thus, we deem the single-item scale to be acceptable, especially considering the findings regarding its convergent and predictive validity. Nevertheless, a lack of reliability may reduce the power of statistical tests and may lead to lower estimates of effect sizes and impedes the scale's ability to predict important outcomes (Nunnally & Bernstein, 1994).

Finally, consistent with theoretical assumptions (e.g., Mumford et al., 2015; West, 2000), each of our three scales predicted team performance. Predictive validity is important in terms of showing that the scales will have practical utility, i.e., will be effective in predicting relevant behavior and outcomes (DeVellis, 2017). This opens up a wide range of possible applications for our scales, including team diagnosis and team development (e.g., Van Dick &

West, 2005). For example, managers can use the measures to predict team performance and provide teams with valuable feedback on their planning behavior.

In terms of practical implications, positive effects from simple interventions with the aim of encouraging team planning, such as the “collective implementation intention”, have already been shown in the laboratory (Thürmer et al., 2015). However, our process model allows more specific and tailored interventions to be devised because the planning behavior of poorly performing teams could be analyzed in more detail (e.g., the extent of prognosis). Based on this, targeted interventions can be made. The goal should not be to stimulate as much planning as possible, but rather to stimulate behavior that is appropriate to the context, which can be determined by comparison with high-performing teams.

2.4.3.1 Limitations and Future Research

There are, admittedly, some limitations to the current study that should be addressed in future research. In terms of the methods, using individual team members to infer team assessments (Samples A and B) and student teams (Samples A and C) limits the external validity of our results. Student samples may differ in their planning behavior from other (non-academic) populations because of socioeconomic differences. However, Belot et al. (2015) found that effects in experimental settings are similar for both student and non-student samples. Therefore, we assume that the use of student samples was not a serious concern. In addition, the sample size and the laboratory setting in Study 2 might limit the robustness of the inferences to be drawn from this study and its external validity. However, the small sample size would indicate a rather conservative test of our hypotheses, as we lack the statistical power to detect true effects, and results found in laboratory studies are often found also in field settings (Dipboye, 1990). Further research using larger samples and examining our hypotheses across different teams, organizations, and longer periods would help to address these limitations.

2.4.3.2 Conclusion

The present study presents a process model of team planning, in which team planning is split into the four processes of exploration, strategic planning, detailed planning, and prognosis. This model provides the methodological basis for developing and validating a long-form scale, a short-form scale, and a single-item scale that enable valid and reliable assessments of team planning to be made. In sum, our work provides a solid foundation for more elaborate theories of team planning processes and offers valid and reliable scales for investigating these processes.

2.5 References

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3 STUDIE 2

EFFECTS OF SITUATIONAL FACTORS ON TEAM PLANNING: A POLICY-CAPTURING APPROACH

Oldeweme, M., Konradt, U., & Garbers, Y. (2021). Effects of situational factors on team planning: A policy-capturing approach. *German Journal of Work and Organizational Psychology*. <https://doi.org/10.1026/0932-4089/a000348>⁵

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3 STUDIE 2

3.1 Abstract

Although there has long been a consensus in team research that planning generally has a positive impact on performance, very little is known about how input factors (e.g., situational factors) affect the planning behavior of teams. In addition, the various dimensions of planning remain largely unexplored. In this study, we examine the effects of time pressure, task routine, and decision importance on team planning. We suggest that planning consists of four dimensions: exploration, strategic planning, detailed planning, and prognosis. In two policy-capturing studies, undergraduates and employees were presented with a series of hypothetical scenarios and asked to indicate in each case how they might plan for these if working as part of a team. Results from our Bayesian multilevel analyses revealed that teams overall used less planning when they were under acute time pressure, when tasks were very routine, and when the decisions involved were of little importance.

3.2 Introduction

Planning is perceived as an important and mandatory process for effective and efficient behavior in individuals, teams, and organizations. The positive relationship between planning and team performance has been proposed in theory (e.g., self-regulation theory, reflexivity, action regulation theory) and proven in research (e.g., Fisher, 2014; Mehta et al., 2009). Although planning is seen as a central team process in improving team performance (West, 2000), we argue that research on team planning is still scarce and fragmented. Specifically, we identify two major shortcomings in existing research on team planning.

First, there is a great diversity of team planning conceptualizations and the measures used to capture team planning (e.g., De Church & Haas, 2008; Janicik & Bartel, 2003). Despite the existing one-dimensional (e.g., Mehta et al., 2009) and multidimensional approaches (e.g., Fisher, 2014), the different behaviors of the entire team planning process are still neglected. In the present study we perceive team planning as a multidimensional construct that captures the diversity of the team planning behaviors.

Second, the antecedents of team planning have so far been neglected. Given the performance-enhancing effect of team planning, it would be valuable for companies to know whether teams are planning or not due to external circumstances. Companies could then take action or provide resources to encourage teams to plan and thus benefit from the performance-enhancing effect of team planning. In particular, it is important to examine situational factors which “refer to broad dimensions of situation characteristics that can be used to describe and compare any situation” (Rauthmann, 2020, p. 4950), as these determine the starting point for teamwork (McGrath, 1984). However, how situational factors (e.g., team member interdependence, task complexity) impact team planning has not been adequately addressed so far. There are only a few studies that have considered the moderating effect of situational factors (e.g., task difficulty) on individual planning (see Mumford et al., 2001, for a summary) although there are several theories that emphasize the importance of specific situational factors. For example, the

resource allocation theory (Norman & Bobrow, 1975) emphasizes the importance of time pressure, the action regulation theory (Hacker, 2005) emphasizes the importance of task routine and the goal-setting theory (Locke & Latham, 2002) emphasizes the decision importance. Drawing on these three theories, the present study is designed to provide the first systematic examination of how situational factors (i.e., time pressure, task routine, and decision importance) affect team planning by using a randomized controlled trial.

3.3 Literature Review and Hypotheses

3.3.1 Team planning

Planning is widely acknowledged to be an important factor for the performance of organizations (Mumford et al., 2001). Since organizations rely more and more on team-based work structures to face the increasing complex demands of modern workplaces (Kozlowski & Bell, 2013), team planning as a predictor of organizational performance is highly relevant. A distinction can be made between central planning, where the formal authority for decision-making rests with the management level, and decentralized planning, where decision-making authority rests with single work teams (Lanaj et al., 2013). As companies nowadays transfer more and more responsibilities to teams (e.g., self-managed teams; Gill et al., 2020), we will focus on decentralized team planning in the following.

Previous research provides several definitions of team planning. For example, McGrath (1984) defined team planning as an activity that “requires the group to lay out a course of action by which it can attain an already chosen objective” (p. 127), thus clearly distinguishing the process of team planning from goal setting. Similarly, Marks et al. (2001) described team planning as the “development of alternative courses of action for mission accomplishment” (p. 365), yet also emphasize the fact that more than one plan can be developed. To combine, we define team planning as a deliberate and cooperative process of generating, selecting, and elaborating future courses of action to be undertaken by team members to achieve task goals.

To understand team planning, one needs to look more closely at its various dimensions. We therefore reviewed the literature, paying attention to theoretical models of planning as those of Mumford et al. (2001), Dörner (2016) and Hacker (2005). In the following we identify similarities between these models and some repeated assumptions in the literature that enabled us to come up with four dimensions of team planning.

First, authors usually assume that planning starts with an information search (e.g., Fisher, 2014; Frese et al., 2007), elaboration of goals (Dörner, 2016), or scanning of the environment (Hacker, 2005; Mumford et al., 2001). We therefore identify *exploration* as the first dimension of planning, defining this as the collection of information relevant to task processing in the future. This includes discussion of what is needed to achieve the chosen goal. It also includes seeking out information on the general conditions, for example the scope for action or important stakeholders. We do not include goal setting as part of team planning since we deem it to be a separate process (cf. McGrath, 1984).⁶

Second, authors assume that overall or basic plans are developed first, which are elaborated in detail later (e.g., Frese et al., 2007; Hayes-Roth & Hayes-Roth, 1979). Similarly, Hacker (2005) distinguishes between designing an action program and deciding on the actual method of execution. We therefore distinguish between the two further dimensions of planning: *strategic planning* and *detailed planning*. During strategic planning, a team generates and weighs up various strategies and possible courses of action that could be taken to achieve its objectives. Detailed planning, in contrast, involves detailed elaboration and refinement of at least one strategy or alternative action. For example, a team makes concrete and binding agreements over how tasks should be distributed and what should be done when.

Finally, planning may also include a mental review of the plan (e.g., Frese et al., 2007). Mumford et al. (2001) also explicitly consider this dimension in their model, when discussing

⁶ Although it is possible to differentiate both processes in terms of content and behavior, it must be acknowledged that they are closely related: Goal setting itself is often seen as a motivational strategy in the way that goals motivate people and are regarded as direct regulators of human actions (Locke & Latham, 2002).

what they term “forecasting”. In this process, the team imagines how plans will be executed and considers the possible obstacles. Our fourth dimension, *prognosis*, is therefore defined as a process of reviewing the possible courses of action regarding their feasibility, efficiency, and effectiveness.

In contrast to other conceptualizations, the planning dimensions of our conceptualization are determined strictly by their function, not by the point at which they occur in the planning process (e.g., Weingart, 2006) and not by the subject of planning (Fisher, 2014). Moreover, it provides a more fine-grained view of team planning, enabling us to distinguish between planning dimensions of different durations and intensities, and thus to differentiate between types of planning.

3.3.2 Situational factors: Time pressure, task routine, and decision importance

Previous team research has focused on the relationship between planning and performance while the influence of input factors on the emergence of team planning has received little attention. Theoretically, the relationship of input factors on team planning and therefore on performance can be embedded in the Input-Mediator-Output-Input model (IMOI; Ilgen et al., 2005). The essential assumption of this framework is that input factors affect group outputs (e.g., team performance) via the interaction between the members (e.g., team planning). Theories which specify the influence of certain factors on the emergence of team planning are currently not available. Mumford et al. (2015) identify situational factors (e.g., time pressure) to influence the planning behavior of leaders. Due to the lack of theories on input factors of team planning behavior, we initially conducted interviews (see pre-study) based on the critical incident technique (Flanagan, 1954) to derive relevant situational factors. The majority of experts mentioned time pressure, task routine, and decision importance as factors that influence team planning. In accordance with Rauthmann (2020), we subsume the above factors under the term “situational factors”. From a theoretical point of view, the above factors can also be derived from resource allocation theory (Norman & Bobrow, 1975), action regulation theory (Hacker,

2005) and goal-setting theory (Locke & Latham, 2002). Although these theories refer to individual action processes, we assume that the situational factors should also have an effect on team action processes (e.g., team planning), drawing on Tschan (2002), who argued that transferring concepts from the individual level to the team level is possible. Therefore and in accordance with findings from Sonnentag and Volmer (2009), who showed that individual and team-related variables are closely associated, we argue that, for example, for a relatively easy task, both teams and individuals would plan less than they would for a much more difficult task.

According to resource allocation theory (Norman & Bobrow, 1975), different processes can compete for the same resources. Hence, when resources are scarce, some processes must be neglected in favor of others that are considered more important. One of the main resources here is time; if time is scarce, a team must decide whether to focus on transition or on action processes. As taking immediate action can result in tangible outcomes that affect performance, Weingart (2006) assumes that teams are likely to prefer action processes. Regardless of the actual value of team planning, the extent to which it is undertaken should therefore decrease when there is greater time pressure, since taking direct action to achieve the goal will seem more appropriate to the team.

Empirical research has shown that temporal nearness leads teams to focus on immediate practical difficulties and to reduce the complexity and effectiveness of plans (e.g., Liberman & Trope, 1998). Additionally, Shure et al. (1962) found that when there is some form of planning session teams undertake more extensive planning. The studies thus indicate that time factors influence the planning process and its quality. The aim of this study is to replicate the influence of time pressure on planning and to extend it to the different aspects of planning. Since all aspects of planning can be considered time-consuming, time pressure should generally affect the planning process as a whole. We therefore hypothesize:

Hypothesis 1: When teams are under time pressure, they will engage in less (a) exploration, (b) strategic planning, (c) detailed planning, and (d) prognosis.

According to action regulation theory (Hacker, 2005), actions are organized hierarchically. Actions, which may refer to planning behavior, tend to be regulated by individuals on lower levels of the hierarchy, where the tasks involve a high degree of routine. More importantly, lower levels of hierarchy are associated with action-regulation that is less conscious. Rousseau and Aubé (2010) stated that task routine reflects the extent to which individuals do their job consistently or repetitively. They claim that “highly routine tasks represent predictable situations that can be resolved using standardized procedures, whereas non-routine tasks are characterized by frequently changing requirements” (p. 758). Therefore, where there is a high degree of task routine, task processing should already be internalized, and planning should no longer be necessary.

However, empirical research on the relationship between team planning and task routine is scarce. Rousseau and Aubé (2010) found that planning activities are more closely associated with team performance when the tasks involve less routine. Since all aspects of planning should be influenced by the previous experience of those carrying out the task, task routine should generally affect the planning process as a whole. We therefore hypothesize:

Hypothesis 2: Where tasks involve a high degree of routine, teams will engage in less (a) exploration, (b) strategic planning, (c) detailed planning, and (d) prognosis.

According to goal-setting theory (Locke & Latham, 2002), certain properties of a goal (e.g., specificity) enhance performance. Since it is assumed that motivational processes such as effort mediate the relationship between goal properties and performance (Scheffer & Kuhl, 2008), these properties should also influence team planning. One crucial factor enhancing performance are incentives associated with goal accomplishment, as reflected in the theory of current state concerns (Klinger, 1977). Similarly, expectancy theory (Vroom, 1964) emphasizes that instrumentality and subjective benefits are important aspects of goal selection. The basic idea in this theory is that individuals act rationally when choosing their goals, selecting those that they feel will deliver the greatest benefit to them. Thus, the more attractive a goal is, the

greater the likelihood that the effort required to achieve it will be rewarded. Both theories focus on aspects of reward. These rewards can depend on situational factors – for example, the decision importance. This is classified as high if the objective itself or the specific actions needed to achieve it are likely to have wide-ranging consequences (e.g., non-reversible actions). As the decision importance increases, a goal is likely to be more challenging, thus giving teams the opportunity to prove themselves. Therefore, the decision importance could influence team planning in a way that a high degree leads to teams planning more.

There has been little empirical research on the relationship between the decision importance and team planning. Johansson and Rouse (1983) demonstrated that pilots plan more when planning activities are crucial for achieving other and more important goals, which indicates decision importance. Smith et al. (1990) also found that challenging goals have a positive effect on the quality of team planning. Because theoretically all aspects of planning should lead to better performance, the decision importance should generally affect the planning process as a whole. We therefore hypothesize:

Hypothesis 3: When the level of decision importance is high, teams will engage in more (a) exploration, (b) strategic planning, (c) detailed planning, and (d) prognosis.

3.4 Method

3.4.1 Present Study

3.4.1.1 Pre-Study

We conducted interviews with five employees from different occupations (e.g., IT project manager, kindergarten teacher) to derive practical relevant influencing factors of team planning behavior, covering a wide range of different planning scenarios. According to critical incident technique (Flanagan, 1954), we asked participants to recall a situation at work in which they were required to achieve a certain goal and where team planning might have been needed. In this study, we asked interviewees to provide more detail on whether they planned as a team, and what they believed made planning take place.

All the interviewees cited the motivation of the team members, their goal orientation, and task routine. All but one named time factors and decision importance. As the motivation of team members and their goal orientation are internal attributes of a person, which are often difficult to influence (e.g., Bell & Kozlowski, 2002), we chose task routine, time pressure and decision importance as situational factors for a first systematic investigation on team planning behavior.

3.4.1.2 Main Studies

We used a policy-capturing design (Aiman-Smith et al., 2002; Karren & Barringer, 2002) to test our hypotheses. This type of design requires individual participants to respond to hypothetical scenarios which contain the experimentally manipulated independent variables as cues. The participants had to have experience in teamwork but did not necessarily have to currently work in a team. In Study 1, we tested our hypotheses using a student sample. Since the planning behavior of students could be affected by a lack of practical experience, in Study 2 we replicated the scenario using an employee sample.

3.4.2 Study 1

3.4.2.1 Participants

Eighty-six undergraduate students were recruited through mailing lists, social networks, and personal contacts to participate in an online survey on team planning, in return for course credits. Five students (5.8%) were excluded prior to the analyses because of inconclusive answers (i.e., response pattern). Of the remaining 81 students, 79% were female, and the average age was 24.69 years ($SD = 3.25$). Students of different disciplines took part in the study, with the majority studying psychology (37%) or teaching (10%). Based on the ratings participants gave in response to questions on teamwork (“I have considerable (team)work experience”), they were deemed to have sufficient teamwork ($M = 3.77$, $SD = 1.01$) and work experience (M

= 2.48, $SD = 1.04$). A five-point Likert scale (1 = *strongly disagree* to 5 = *strongly agree*) was used for rating purposes.

3.4.2.2 Materials and Design

We used a 2 x 2 x 2 complete crossover within-subjects factorial design, with the manipulated variables (independent variables) being time pressure (high/low), task routine (high/low) and decision importance (high/low). This gave us eight different scenarios. For each of the scenarios (see Appendix A) we devised a short summary of a situation at work that involved a combination of the independent variables. Participants ($N = 81$) were asked for each of the eight different scenarios to indicate the extent to which they thought their fictive team was likely to plan in that situation resulting in 648 observations. Participants were told to make realistic assessments and not to indicate desirable behavior. When designing the scenarios, we followed widely used guidelines (Aiman-Smith et al., 2002; Karren & Barringer, 2002). As recommended by Karren and Barringer (2002), we also included a description of the work context to help participants put themselves in the situation and to keep certain elements of the scenario consistent when presenting the various scenarios to the participants. Thus, participants were told that they were working in a team of five, with a good working atmosphere, and that they had a clear goal but a free reign in terms of how to work. We checked the comprehensibility of the scenarios and the general work description as well as the manipulation of the factors within a pre-test with seven students. All students rated the cues (high/low) as we had intended. We used two random orders of scenarios to control for sequencing effects. In addition, one random scenario was replicated for each sequence to assess judgment consistency, resulting in nine scenarios being assessed by each participant.

3.4.2.3 Measures

As the independent variables have been manipulated, only the dependent variables were assessed via questionnaire. We assessed team planning using a four-dimensional measure that

included exploration (e.g., “We will bring to mind the specifications we need to meet”), strategic planning (e.g., “We will discuss different possibilities on how to achieve our goal”), detailed planning (e.g., “We will discuss in detail how we want to proceed”), and prognosis (e.g., “We will discuss whether our plan will lead to our goal”). Four items were used to cover each dimension. We created the items based on our definitions of the four planning dimensions and additionally reviewed existing planning scales to reassign items where possible. To assess team planning as a group-level variable although we asked individuals, we used a referent-shift model (Chan, 1998). Thus, participants were asked to assess the amount of planning in a fictional group (“we”). The items were measured using a five-point Likert scale, ranging from 1 (*not at all*) to 5 (*to a great extent*). The scales showed good internal consistency (exploration: $\alpha = .92$; strategic planning: $\alpha = .92$; detailed planning: $\alpha = .89$; prognosis: $\alpha = .90$).

As each participant worked through all scenarios, we asked the participants for demographic data (e.g., sex, work experience) to test whether between-person differences had an impact on team planning. We also checked the ease with which participants felt they could imagine the scenarios (“I could easily put myself in the different situations”) as this might influence responses by including a single question at the end of the questionnaire; again, a five-point Likert scale (1 = *strongly disagree* to 5 = *strongly agree*) was used for this item. To examine whether common method bias might explain the results observed, we measured credibility as a marker variable (Podsakoff et al., 2003), as it is theoretically unrelated to the dependent and independent variables in this study. Credibility was measured using three items (e.g., “I will confidently rely on the information that other team members bring to the discussion.”) from Lewis’s (2003) scale (Cronbach’s $\alpha = .86$).

3.4.2.4 Analyses

To test the underlying four-dimensional factor structure of our planning measure, we conducted a confirmatory factor analysis (CFA) using Mplus 8.3 (Muthén & Muthén, 1998-2017). According to conventional criteria (Hu & Bentler, 1999), a good fit is indicated by a

Comparative Fit Index (CFI) and the Tucker-Lewis index (TLI) close to .95 or greater. Additionally, the root mean square error of approximation (RMSEA) should be close to or below .08, and the standardized root mean square residual (SRMR) should be close to or below .06. The chi-square difference test was used to compare different nested models.

Because of the use of a within-person-design (each participant responded to all scenarios) the obtained data can be considered as nested. To account for the dependence in the data, hypotheses were tested with multilevel Bayesian structural equation modeling as recommended by Aguinis and Bradley (2014). This method allows one to test simultaneously the within-person effect of each of the three manipulated independent variables on the four team planning dimensions (level 1) and also enables one to examine whether between-person differences in demographic variables (level 2) affect the degree of team planning as dependent variable. We decided to use the Bayes estimator because of the small sample size and the complexity of the model. Missing data for the control variables⁷ (4.9%) were estimated using the Bayesian imputation method, which is similar to the approach used in the FIML algorithm (Graham, 2009). To test our hypotheses, we regressed each planning dimension on time pressure, task routine, and decision importance (each group-mean centered), taking the control variables at level 2 into account. A well-specified model fit was indicated by a posterior predictive p-value (PPP) higher than .05, and a posterior predictive checking (PPC) 95% credibility interval (CI) that had included a negative lower limit and a positive upper limit (Zyphur & Oswald, 2015).

3.4.2.5 Results

Means, SDs, and bivariate correlations are presented in Table 3.1.

⁷ Due to the way the online tool was configured, missing data could only occur for the demographic/control variables.

Table 3.1*Means, Standard Deviations, and Correlations among Study Variables (Study 1)*

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Independent variables</i>															
1 Importance ^{a,c}	-	-													
2 Time pressure ^{a,c}	-	-	-												
3 Routine ^{a,c}	-	-	-	-											
<i>Dependent variables</i>															
4 Exploration ^a	3.77	0.98	.41**	.02	-.41**	(.92)									
5 Strategic planning ^a	3.27	1.04	.36**	-.19**	-.47**	.69**	(.92)								
6 Detailed planning ^a	3.29	0.99	.49**	-.12**	-.25**	.62**	.69**	(.89)							
7 Prognosis ^a	3.37	0.97	.33**	-.08*	-.37**	.68**	.68**	.69**	(.90)						
8 Credibility ^a	3.86	0.80	-.22**	.09*	.25**	-.21**	-.28**	-.24**	-.23**	(.86)					
<i>Control variables</i>															
9 Age ^b	24.70	2.32	-	-	-	.03	.00	.02	.08*	-.13*	-				
10 Sex ^{b,d}	-	-	-	-	-	.01	-.04	-.05	-.12**	-.03	.02	-			
11 Team experience ^b	3.77	1.01	-	-	-	.09*	.01	.04	.13**	-.02	.17**	.22**	-		
12 Work experience ^b	2.48	1.04	-	-	-	-.03	-.02	-.04	.04	.04	.54**	.05	.48**	-	
13 Sequence ^b	1.56	0.50	-	-	-	-.08*	.01	-.06	-.08*	-.08*	-.22**	-.03	-.16**	-.14**	-
14 Ease of imagination ^b	3.60	0.77	-	-	-	.09*	.00	.07	.03	.03	.16**	-.03	.13**	.17**	-.12**

Notes. ^a $N = 648$ observations (Level 1). ^b $N = 81$ participants (Level 2). Because the study utilized a completely crossed design, correlations

among independent variables are zero by definition, and are therefore not shown. ^c 0 = high, 1 = low. ^d 1 = male, 2 = female. Numbers in parentheses are reliabilities where appropriate. For all dichotomous variables the spearman rank-order correlation coefficient is given. * $p < .05$ (two-sided). ** $p < .01$ (two-sided).

3.4.2.5.1 Pre-Analyses

Because we found significant correlations at least with one dependent variable, age, sex, and teamwork experience were included in further analysis as level-2 predictors to consider variance at individual level as recommended by Aguinis and Bradley (2014).

Validity of Measures. We checked the four-factorial structure of the team planning measure using a CFA. The fit of the four-factor solution showed a good fit for the hypothesized four-factor model and was better than the other models (for details, see Appendix B). Discriminant validity was assessed by comparing the average variance extracted (AVE) of each dimension to all the correlations between it and other dimensions. As required, all AVEs were greater than any of the squared correlations between the corresponding dimension and another dimension (see Fornell & Larcker, 1981).

Ease of imagination. Because the manipulation of the factors was already checked during their construction, we decided to not use a classic manipulation check. Instead, we checked whether participants were able to imagine the scenarios as this might influence responses. Only eight people indicated that they had problems doing this (as indicated by a rating of ‘strongly disagree’ or ‘disagree’ on the relevant item). As we found a significant correlation between the ease of imagination and one of our dependent variables, we included the ease of imagination as a level-2 predictor in our analyses.

Common Method Bias. To assess the amount of the common method bias, we inspected the correlation of all planning dimensions using credibility as the marker variable (Podsakoff et al., 2003). Correlations with dependent variables were small ($r = -.21$ to $-.28$). Only 4.41% to 7.84% of the variance was explained by this method. The results thus indicate that common method bias was negligible.

Sequencing effect. Concerns regarding sequencing effects, where the order of questions might have a bearing on the results, were controlled for by ensuring respondents randomly received

one of two versions of the survey. Additionally, we included sequence as a level-2 predictor in our analyses.

Judgment Consistency. We calculated judgment consistency using the square root of the difference between the total variance in an individual's judgment minus the variability in individual's evaluation of the repeated scenarios divided by their total variance (cf. Hammond et al., 1975). Consistency was medium to high (ranging from .68 to .82), indicating that participants' judgment was stable when they were responding to the same scenario.

3.4.2.5.2 Hypotheses Testing

Summary statistics are presented in Table 3.2. Hypothesis 1a, which predicted that time pressure would lead to less exploration, was rejected ($\beta = .02, ns.$). Hypotheses 1b-d, which predicted that time pressure would lead to less strategic planning, detailed planning, and prognosis, received support (strategic planning: $\beta = -.19, p < .01$; detail planning: $\beta = -.13, p < .01$; prognosis: $\beta = -.10, p < .01$). In support of Hypotheses 2a-d, a high level of task routine was found to lead to less exploration, strategic planning, detailed planning, and prognosis (exploration: $\beta = -.46, p < .01$; strategic planning: $\beta = -.51, p < .01$; detail planning: $\beta = -.29, p < .01$; prognosis: $\beta = -.43, p < .01$). Hypotheses 3a-d were also supported, showing that a high level of decision importance leads to more exploration, strategic planning, detailed planning, and prognosis (exploration: $\beta = .46, p < .01$; strategic planning: $\beta = .39, p < .01$; detail planning: $\beta = .53, p < .01$; prognosis: $\beta = .38, p < .01$).

Table 3.2

Multilevel Model Results of Time Pressure, Decision importance and Routine on the Four Team Planning Dimensions (Study 1)

Variable	Exploration				Strategic planning				Detailed planning				Prognosis			
	β	<i>SD</i>	95% CI		β	<i>SD</i>	95% CI		β	<i>SD</i>	95% CI		β	<i>SD</i>	95% CI	
<i>Intercept</i>	6.61	1.36	4.18	9.41	7.02	1.52	4.09	9.91	6.37	1.33	4.00	8.98	5.35	1.30	2.77	7.70
<i>Controls</i>																
Sex ^b	-0.03	0.11	-0.24	0.19	-0.07	0.12	-0.27	0.15	-0.12	0.12	-0.36	0.14	-0.27*	0.11	-0.48	0.04
Age	-0.02	0.12	-0.26	0.20	0.00	0.12	-0.24	0.20	0.03	0.12	-0.24	0.25	0.10	0.11	-0.14	0.30
Team experience	0.16	0.13	-0.10	0.40	0.03	0.13	-0.25	0.28	0.02	0.14	-0.19	0.32	0.27*	0.12	0.04	0.49
Ease of imagination	0.14	0.12	-0.10	0.35	0.01	0.13	-0.29	0.25	0.13	0.14	-0.15	0.38	-0.01	0.11	-0.25	0.22
Sequence	-0.11	0.11	-0.33	0.09	0.03	0.12	-0.20	0.24	-0.11	0.12	-0.33	0.14	-0.09	0.11	-0.27	0.16
<i>Independent variables</i>																
Time pressure ^a	0.02	0.03	-0.04	0.08	-0.19**	0.03	-0.24	-0.13	-0.13**	0.03	-0.19	-0.07	-0.10**	0.03	-0.15	-0.03
Importance ^a	0.46**	0.03	0.40	0.51	0.39**	0.03	0.33	0.43	0.53**	0.03	0.47	0.57	0.38**	0.03	0.32	0.44
Routine ^a	-0.46**	0.02	-0.51	-0.42	-0.51**	0.02	-0.55	-0.46	-0.29**	0.03	-0.35	-0.23	-0.43**	0.03	-0.48	-0.37
R ² _W / R ² _B	.43 /.11				.44 /.07				.38 /.10				.33 /.22			

Notes. $N = 81$ participants (648 data points). ^a 0 = high. 1 = low. ^b 1 = male. 2 = female. PPP = .409. DIC = 5707.46.

* $p < .05$ (one-sided). ** $p < .01$ (one-sided).

3.4.3 Study 2

To ensure external validity and provide further validation of the results of Study 1, we replicated Study 1 using an employee sample using the same method and design. In this second study, the only difference to Study 1 was that we adjusted how we manipulated the task routine variable (see Appendix A).⁸

3.4.3.1 Participants

One hundred and seven employees were recruited using social networks, notice boards, and personal contacts to participate in an online survey on team planning. Six individuals (5.6%) were excluded prior to the analyses because of inconclusive answers (i.e., all items were answered with maximum agreement). Of the remaining 101 employees, 59% were female, and their average age was 32.11 years ($SD = 10.80$). Participants were found to have sufficient teamwork experience ($M = 3.88$, $SD = 0.84$) and to have an average of 8.51 years of work experience ($SD = 10.29$).

3.4.3.2 Analyses

As in Study 1, we conducted a CFA to test the underlying four-dimensional factor structure of our planning measure and we used multilevel Bayesian structural equation modeling to test our hypotheses.

3.4.3.3 Results

Means, SDs, and bivariate correlations are presented in Table 3.3.

3.4.3.3.1 Pre-Analyses

Because of significant correlations to dependent variables, only sex and teamwork experience were included in further analysis as level-2 predictors. As in Study 1, before testing

⁸ We adapted the manipulation of routine based on a suggestion by a reviewer. The manipulation no longer implies that the team already has a plan and refers more to the underlying construct of the task routine.

the hypotheses, we checked the validity of the measure (see Appendix B), the ease of imagination, judgment consistency, common method bias, and possible sequencing effects. Results of these checks are not reported if there was no evidence for concerns. Again, we included the ease of imagination as a level-2 predictor in our analyses, since fourteen people indicated that they had problems imagining the scenario, and we found significant correlations between the ease of imagination and our dependent variables. Judgment consistency was medium to high (ranging from .70 to .83) for all of the dimensions, except exploration and credibility ($< .70$). To prevent a possible sequencing effect, respondents were randomly allocated to one of two versions of the survey and we included sequence as a level-2 predictor in our analyses.

3.4.3.3.2 Hypotheses Testing

Summary statistics are presented in Table 3.4. Hypothesis 1a, which predicted that time pressure would lead to less exploration, was rejected ($\beta = -.03$, *ns.*). Hypotheses 1b-d, which predicted that time pressure would lead to less strategic planning, detailed planning, and prognosis, received support as all the coefficients differed significantly from zero (strategic planning: $\beta = -.18$, $p < .01$; detail planning: $\beta = -.09$, $p < .01$; prognosis: $\beta = -.08$, $p < .01$). In support of Hypotheses 2a-d, we found that a high degree of task routine led to less exploration, strategic planning, detailed planning, and prognosis (exploration: $\beta = -.41$, $p < .01$; strategic planning: $\beta = -.47$, $p < .01$; detail planning: $\beta = -.28$, $p < .01$; prognosis: $\beta = -.41$, $p < .01$). Hypotheses 3a-d were also supported, as the results showed that a high degree of decision importance led to more exploration, strategic planning, detailed planning, and prognosis (exploration: $\beta = .55$, $p < .01$; strategic planning: $\beta = .43$, $p < .01$; detail planning: $\beta = .54$, $p < .01$; prognosis: $\beta = .45$, $p < .01$).

Table 3.3*Means, Standard Deviations, and Correlations among Study Variables (Study 2)*

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Independent variables</i>															
1 Importance ^{a,c}	-	-													
2 Time pressure ^{a,c}	-	-	-												
3 Routine ^{a,c}	-	-	-	-											
<i>Dependent variables</i>															
4 Exploration ^a	3.59	1.04	.51**	-.02	-.36**	(.93)									
5 Strategic planning ^a	3.15	1.06	.39**	-.17**	-.43**	.75**	(.92)								
6 Detailed planning ^a	3.23	1.02	.49**	-.09*	-.25**	.71**	.77**	(.91)							
7 Prognosis ^a	3.23	0.99	.41**	-.07	-.37**	.73**	.75**	.73**	(.90)						
8 Credibility ^a	3.94	0.86	-.21**	.04	.39**	-.28**	-.25**	-.25**	-.24**	(.90)					
<i>Control variables</i>															
9 Age ^b	32.11	10.75	-	-	-	.00	.03	.06	-.01	-.07*	-				
10 Sex ^{b,d}	-	-	-	-	-	.08*	.02	.06	-.00	.08*	-.26**	-			
11 Team experience ^b	3.88	0.84	-	-	-	.10**	.12**	.12**	.10**	.07	.01	-.05	-		
12 Work experience ^b	8.51	10.24	-	-	-	-.02	.02	.03	-.01	-.01	.88**	-.15**	.05	-	
13 Sequence ^b	1.59	0.49	-	-	-	-.09*	-.15**	-.16**	-.05	.08*	-.19**	.02	.10**	-.15*	-
14 Ease of imagination ^b	3.57	0.85	-	-	-	.07*	.09*	.10**	.15**	.13**	.02	-.05	.39**	-.02	.08*

Notes. ^a *N* = 808 observations (Level 1) ^b *N* = 101 participants (Level 2). Because the study utilized a completely crossed design, correlations among independent variables are zero by definition, and therefore are not shown. ^c 0 = high, 1 = low. ^d 1 = male, 2 = female. Numbers in parentheses are reliabilities where appropriate. For all dichotomous variables the spearman rank-order correlation coefficient is given. * *p* <.05 (two-sided). ** *p* <.01 (two-sided).

Table 3.4*Multilevel Model Results of Time Pressure, Decision importance and Routine on the Four Team Planning Dimensions (Study 2)*

Variable	Exploration				Strategic planning				Detailed planning				Prognosis			
	β	<i>SD</i>	95% CI		β	<i>SD</i>	95% CI		β	<i>SD</i>	95% CI		β	<i>SD</i>	95% CI	
<i>Intercept</i>	6.12	1.00	4.24	8.12	5.43	0.90	3.69	7.19	5.40	0.90	3.66	7.17	5.52	0.98	3.67	7.50
<i>Controls</i>																
Sex ^b	0.19	0.10	-0.02	0.39	0.08	0.10	-0.13	0.27	0.12	0.10	-0.08	0.31	0.03	0.11	-0.18	0.24
Team experience	0.22	0.11	-0.01	0.42	0.24*	0.11	0.02	0.44	0.22*	0.11	0.01	0.43	0.13	0.12	-0.10	0.35
Ease of imagination	0.10	0.11	-0.12	0.32	0.13	0.11	-0.09	0.33	0.15	0.11	-0.07	0.35	0.28*	0.11	0.05	0.48
Sequence	-0.22*	0.10	-0.40	-0.01	-0.34**	0.09	-0.51	-0.14	-0.35**	0.09	-0.51	-0.15	-0.13	0.11	-0.33	0.08
<i>Independent variables</i>																
Time pressure ^a	-0.03	0.03	-0.08	0.02	-0.18**	0.03	-0.23	-0.13	-0.09**	0.03	-0.15	-0.04	-0.08**	0.03	-0.13	-0.02
Importance ^a	0.55**	0.02	0.51	0.59	0.43**	0.02	0.39	0.48	0.54**	0.02	0.50	0.58	0.45**	0.02	0.40	0.49
Routine ^a	-0.41**	0.02	-0.45	-0.36	-0.47**	0.02	-0.51	-0.43	-0.28**	0.03	-0.33	-0.23	-0.41**	0.03	-0.46	-0.36
R^2_W / R^2_B	.47 /.17				.44 /.22				.39 /.23				.38 /.15			

Notes. $N = 101$ participants (808 data points). ^a 0 = high. 1 = low. ^b 1 = male. 2 = female. PPP = .181. DIC = 6270.41.

* $p < .05$ (one-sided). ** $p < .01$ (one-sided).

3.5 Discussion

The purpose of this study was twofold. First, we pursued the idea that team planning is a multidimensional construct consisting of exploration, strategic planning, detailed planning, and prognosis, which is supported by the results of the factor analysis. Second, we examined the effects of time pressure, task routine, and decision importance on team planning to provide companies with information about situational factors under which they should take action to encourage teams to plan and thus benefit from the performance-enhancing effect of team planning. The results indicate that team planning tends to be used when there is a high level of decision importance, when tasks are not routine, and when there is little or no time pressure. The only exception was the effect of time pressure on exploration, which we could not confirm.

Our results provide initial evidence regarding the multidimensional structure of team planning. These findings are central because one-dimensional approaches may underspecify the focal construct and thus lack content validity, as they do not reflect the complexity and diversity of behaviors involved (cf. Konradt et al., 2015). This may also have led to the occasional non-significant findings on the relationship between team planning and team performance (e.g., Lei et al., 2016). Dividing up the planning process on the function of the various planning dimensions is also beneficial in that it allows us to present a conceptualization of planning that is separate from the precise nature of what is being planned and can be used universally.

Moreover, we investigated how various situational factors affect team planning, which has been largely neglected in previous research. In accordance with different theories of organizational psychology (Hacker, 2005; Locke & Latham, 2002; Norman & Bobrow, 1975), our findings suggest that teams plan more when they are under no time pressure, when tasks are not routine, and when there is a high level of decision importance. The results illustrate the importance of the conditions which teams find themselves in when starting their tasks and this is something that needs to be given more consideration both in theory and practice.

Interestingly, the effects of decision importance and task routine are significantly greater than those of time pressure. Moreover, we did not find time pressure to have a significant effect on exploration, which contradicts our assumption that teams under time pressure tend to take immediate action instead of searching for relevant information. Thus, the affective state associated with time pressure may not be sufficiently evoked in the cognitive approach chosen with the policy-capturing design, which is usually free of emotional evaluation (cold cognition; Schwarz, 1998). However, time pressure can lead to emotional strain, such as exhaustion (Syrek et al., 2013), which may affect team processes (Ellis, 2006).

The results of our study are also relevant from a practical point of view since a low level of team planning is negatively associated with team effectiveness (e.g., West, 2000). Our results suggest that situational factors inhibit team planning. Therefore, companies should ideally avoid, for example, situations in which teams work under acute time pressure and use routines blindly. Teams need to be given a sufficiently generous timeframe in which to complete their tasks, and it should be reviewed regularly. However, companies will not always be able to avoid acute time pressure. Although routines can help to save resources (Hacker, 2005), they can also lead to old strategies neglecting new or changed conditions, making them not very effective. Here, targeted consultative coaching (Hackman & Wageman, 2005) - in which team are externally encouraged to rethink old strategies and to look for possible new, more efficient strategies - could help to inspire team planning behavior. This would not necessarily force teams to plan but to encourage them to consider team planning.

3.5.1 Limitation and Strengths

As with all studies, we must consider the methodological limitations. Because of the policy-capturing approach used here, the external generalizability of our findings must be questioned (Aguinis & Bradley, 2014; Karren & Barringer, 2002). As the participants have only been given short descriptions of the situation, this is somewhat different from real life, where significantly more information would be available. However, Rogelberg et al. (1999) have

shown that policy-capturing studies have a high level of generalizability. To make our experimental study more realistic, we gave the participants a general job description before each scenario. Overall, it is therefore assumed that this is reasonably similar to real life.

As is common in the individual-centered policy-capturing method (Aguinis & Bradely, 2014), we used assessments by individual team members to infer team assessments, which is a possible limitation of the study. More precisely, we asked individuals to rate the planning intentions of their fictive team – as stated in the work description – by using a referent-shift model (Chan, 1998). Although the participants stated that they were able to imagine the situation well and thus in a fictitious team, we did not capture the planning intention of a whole team, but rather the team planning intentions of single team members – although these certainly contribute to the determination the former. As a result, we did not consider aspects such as motivational losses, team interaction or team dynamics, which influence team performance and team processes (Mathieu et al., 2008). Future studies should therefore check the validity of our research by considering all members of a team.

Furthermore, we were only able to prove the factorial validity of the multidimensional structure of team planning. In particular, evidence regarding predictive validity, which reflects the practical concern of demonstrating the utility of scales to predict relevant behavior and outcomes (DeVellis, 2017), is missing. It would be of primary interest to detect different effects of the dimensions on team working and performance and whether a particular planning focus (e.g., balanced focus on all four planning dimensions) is associated with high performance - similar to what has been found in reflection research (Otte et al., 2018). Future research that thoroughly addresses the proposed multidimensional structure and its properties is therefore indispensable.

Despite these limitations, our study also shows some strengths, particularly the fact that we used two independent samples and a randomized and controlled examination design (cf. Karren & Barringer, 2002). First, by manipulating the situational factors, we can avoid problems due to multicollinearity, which often occur in field settings (e.g., Feldman & Arnold,

1978). This enables us to capture the unadulterated effects of the manipulated variables. Second, when using this self-report procedure, the effects of social desirability are significantly weaker than when subjects are asked to evaluate or rank the variables of interest in order of importance. Third, the experimental setting allows us to draw causal conclusions regarding the effect of the situational factors on team planning, which is indispensable for the development of theories.

3.5.2 Future Research

Our study provides important insights into the construct of team planning and the impact of situational factors on it. However, two main directions for future research concerning team planning and performance were not addressed in this study. First, the consequences of a lack of team planning behavior (e.g., worse team performance) should be examined in more detail as the generally positive effect of team planning on performance is repeatedly questioned due to its time- and resource-intensive nature (Frese et al., 2007; Frese et al., 2015). Future research should therefore examine whether all planning dimensions always have a positive effect on team performance, regardless of situational factors (e.g., task difficulty). Subsequently, it is important to examine whether teams are aware of a possible negative impact of team planning dimensions under certain situational factors and consequently devote less time to them or not.

Second, as we focused on situational factors, it is mandatory to consider other input factors – also because a reasonably comprehensive taxonomy of situational characteristics is missing (Rauthmann, 2020). A possible conceptualization of input factors for further research and models in this area is the classification of Mathieu et al. (2008), who propose in their review a subdivision into factors of team composition (e.g., personality), factors at team level (e.g., team structure) and factors of organization or context (e.g., cultural influences).

3.5.3 Conclusion

This study makes a valuable contribution to team planning literature mainly in two ways. First, it shows that team planning is a multidimensional construct which provides a more solid and universal conception, allowing to measure the process detached from the content. Second, the study provides a systematic examination of how situational factors affect team planning. The results show that the amount of team planning increases when there is little or no time pressure, when tasks are not routine, or when there is a high level of decision importance.

3.6 References

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3.7 Appendix

3.7.1 Appendix A

Table 3.5

Manipulation of Independent Variables

	Decision importance	Time pressure	Task routine ^a
High	Your employer introduces you to your assignment in more detail. It is very important for both the team and the company, since it is connected to other assignments.	Your employer also highlights repeatedly that this assignment needs to be dealt with as soon as possible. It ought to have been finished long ago.	<p>While your employer explains the assignment, you notice that you have already worked on similar tasks. You already have an idea how to approach it.</p> <p><i>While your employer explains the assignment, the team notices that the task seems familiar. Your team has already handled such tasks many times.</i></p>
Low	Your boss introduces you to your assignment in more detail. It is not of importance for the company or for your team but it needs to be done.	Your employer also stresses repeatedly that you are not pressed for time for this assignment. The customer expects a result in a few months' time.	<p>While your employer explains the assignment, you notice that you have not yet worked on such a task. You have no idea how to approach it.</p> <p><i>While your employer explains the assignment, the team notices that the task seems unknown to them. Your team has never handled such a task before.</i></p>

Note. ^a The adjusted manipulation of routine in Study 2 is shown in italics.

3.7.2 Appendix B

Table 3.6

Construct Validity for the Team Planning Measure

Model	χ^2	df	$p <$	CFI	TLI	RMSEA	SRMR	χ^2 -Diff
<i>4-Factor (Exploration, Strategic Planning, Detailed planning, Prognosis)</i>								
Study 1	324.40	98	0.001	.97	.97	.06	.03	$p < .01$
Study 2	387.48	98	0.001	.98	.97	.06	.02	$p < .01$
<i>3-Factor (Exploration, Strategic Planning + Detailed planning, Prognosis)</i>								
Study 1	808.39	101	0.001	.92	.90	.10	.05	$p < .01$
Study 2	834.70	101	0.001	.94	.93	.10	.03	$p < .01$
<i>1-Factor (Planning)</i>								
Study 1	1896.22	104	0.001	.79	.75	.16	.07	--
Study 2	2021.62	104	0.001	.84	.81	.15	.06	--

Note. Study 1: $N = 648$. Study 2: $N = 808$. CFI = comparative fit index; TLI = Tucker-Lewis-

Index; RMSEA = root-mean-square error of approximation; SRMR = standardized root-mean-square residual.

4 STUDIE 3

THE RHYTHM OF TEAMWORK: DISCOVERING A COMPLEX TEMPORAL PATTERN OF TEAM PROCESSES

Oldeweme, M., Konradt, U., & Brede, M. (2021). *The Rhythm of Teamwork: Discovering a Complex Temporal Pattern of Team Processes* [Manuscript submitted for publication]. Institute of Psychology, Kiel University.

4 STUDIE 3

4.1 Abstract

The recurring phase model of team processes suggests that there is a rhythm of team task accomplishment ('rhythm of teamwork'), referring to a repeated sequence of transition and action phases over time. Though the recurring phase model has been widely accepted and used, there has not yet been any empirical investigation of this rhythm. Drawing on the recurring phase model, we hypothesized that different types of teamwork rhythm would emerge, that the rhythm would vary according to the type of task, and also would be related to team performance. To test our hypotheses, we observed and videoed teams working on two different tasks (a creative and a construction task) in a laboratory setting. The rhythm of teamwork for each team was determined using four parameters: tempo, regularity of tempo, focus (transition vs. action), and variability of focus. Latent profile analysis yielded three distinct rhythms of teamwork across both tasks. The results also show that teams adapt their rhythm to the task they are working on. Moreover, for the creative task, a changing-focus rhythm was predictive of lower performance, but for the construction task the three distinct types of teamwork led to no discernible differences in performance.

4.2 Introduction

With the increasing use of teams in organizational work, there has been a growing interest in team processes, which are considered to be a critical factor of team performance on both a theoretical and empirical level (e.g., Ilgen et al., 2008; Lepine et al., 2008). In this context, the recurring phase model of team processes by Marks et al. (2001) has served as the theoretical basis for many studies (see McComb & Kennedy, 2020). The underlying taxonomy of team processes of the model has already been meta-analytically validated (LePine et al., 2008). Furthermore, the model also integrates a temporal perspective in the postulated rhythm of team task accomplishment ('rhythm of teamwork') which has not been empirically investigated so far. The rhythm of teamwork describes a cyclical sequence of transition and action phases of different lengths (clusters of specific team processes) that vary in tempo, regularity, focus (transition vs. action), and variability of focus. The lack of an empirical investigation is surprising, given that the dynamic of team processes depicted in the rhythm of teamwork has increasingly come to the attention of researchers in recent years (e.g., Kozlowski & Chao, 2018; Mohammed et al., 2009). Initial empirical findings support the importance of the dynamics of team processes regarding team performance (e.g., Tschan, 2002). However, the rhythm of teamwork is a complex temporal phenomenon whose empirical investigation is significantly hampered and inhibited by a lack of adequate methods (Ancona et al., 2001). To date, little is known about whether a rhythm of teamwork can be observed, whether it varies across teams and tasks, and whether it is related to team performance.

However, investigating the rhythm of teamwork can contribute significantly to the understanding of how teams function. Unlike previous research, the focus is not on the dynamic of a particular team process in the form of trajectories (Konradt & Eckhardt, 2016) or descriptive measures of time (e.g., timing; Kennedy & McComb, 2014), but on the aggregate of the entirety of different team processes. In this way, the rhythm of teamwork allows a holistic view of the interdependent team processes. The resulting complex temporal pattern can be mapped

over a longer period of hours or days. Based on this, strategies and tactics of task accomplishment as well as their correlations to team performance can be identified in order to finally derive evidence-based implications for practice. According to Marks et al. (2001), identifying transition and action phases is crucial to understanding not only *which* team processes (e.g., planning) are instrumental to accomplishing the task but also *at which point in time* they are critical.

The primary aim of the present study is to advance our understanding of the rhythm of teamwork. First, we establish a methodological approach to capture the rhythm of teamwork. Then we validate this methodology by gathering data unobtrusively in a laboratory setting. We examine the main assumptions regarding different types of rhythms of teamwork and determine how they vary with the type of task and how they are related to team performance.

4.3 Theoretical Background

4.3.1 Recurring Phase Model of Team Processes

The recurring phase model of team processes by Marks et al. (2001) differentiates between two kinds of team processes: transition processes and action processes.⁹ While transition processes are concerned with planning and evaluating goal-oriented actions, action processes are used for team actions that are directly linked to accomplishing the goal. Building on this, transition phases and action phases are defined as clusters of transition or action processes. The central idea of the recurring phase model is that, while working on a task, a team goes through multiple action and transition phases that form a pattern over time, which is described as the rhythm of teamwork. Given that these phases are defined as clusters of the processes executed by teams, it becomes clear that different teams may show different types of rhythm.

Marks et al. (2001) assume that the frequency and predictability of switching between transition and action phases, as well as the duration of the phases, depend on several factors (e.g., common goals, norms, leadership). However, the authors give special importance to time

⁹ In addition, interpersonal processes are defined, but these are not relevant in the present paper and will therefore not be considered further here.

factors of the tasks (e.g., project deadlines), which should have a significant influence on the task processing of teams and thus on the rhythm of teamwork. They assume that different tasks require more or fewer transition and action phases and that there may also be work breaks in between. Consequently, the rhythm of teamwork should be influenced by the task being worked on.

Furthermore, Marks et al. (2001) assume that the different team processes are relevant at different times. The transition and action phases of a task indicate not only *which* team processes (e.g., planning) are instrumental to accomplishing the task but also *at which point in time* they are critical. Consequently, the rhythm of teamwork has a descriptive function but can also have a complementary predictive function by clarifying whether teams succeed in showing a rhythm appropriate for the task.

4.3.2 Definition of Rhythm

Marks et al. (2001) do not define the term rhythm but instead depict it as a recurring sequence of transition and action phases of differing lengths, punctuated by breaks. Drawing on Aguinis and Bakker's taxonomy (2020), we define rhythm as the complex temporal pattern of a certain number of elements that is characterized by four measures: duration (i.e., temporal length of a phenomenon in units of time such as seconds), frequency (i.e., the number of times events occur over a specific period), timing (i.e., points in time such as the beginning of the task), and sequence (i.e., the order in which phenomena occur). In this way, rhythm constitutes an overarching characteristic of any sequence of recurring processes. The rhythm of teamwork can therefore be described as a sequence of action and transition phases with varying durations, and with breaks that occur at different points.

4.3.3 Empirical Findings and Methodical Approaches to Identifying the Rhythm of Teamwork

Even though the recurring phase model of team processes is widely used in team research (see McComb & Kennedy, 2020), the assumption that the rhythm of teamwork follows

a cyclical sequence of transition and action phases has not yet been investigated. To our knowledge, there is only one empirical study in the field of team research that deals with a rhythm. McComb and Kennedy (2020) investigated the rhythm of team communication, which was described as the repetition of cycles within the teams' conversations, by use of recurrence quantification analysis (Knight et al., 2016). Through this analysis, the rhythm of team communication could be measured by looking, for example, at the stability (i.e., density of recurrence) of the processes involved. A downside to this method of capturing rhythm is that the measures always refer to recurrence. When applying this method, McComb and Kennedy (2020) only considered the repetition of team processes and not their cyclical sequence over time, thus not considering the duration of single processes, their frequency, and the relationship between the various processes.

A possible solution to overcome this limitation is offered by the approach of Klarner and Raisch (2013), who examined the rhythm of changes in the strategy of insurance businesses. Different rhythms were determined by examining the firms' level of strategic stability or change, and identified using a classification procedure. This allows for a better understanding of the rhythm by taking into account the duration of individual processes, their frequency and the relationships between different processes. Klarner and Raisch's methodology (2013) provides a way of classifying rhythms into different types (regular, focused, punctuated, or temporarily switching).

4.3.4 Purpose of the Present Study

The aim of the present study is to investigate the rhythm of teamwork to advance our understanding of complex temporal patterns that emerge from the collective orchestration of several team processes. For this purpose, we developed a new method that captures the temporal pattern of the rhythm of teamwork. This method will then be used to test the three main assumptions of Marks et al. (2001) concerning the rhythm of teamwork. First, when teams are undertaking a task, the rhythm can be observed as a recurring sequence of transition and action

phases. Inspired by Klarner and Raisch (2013), we argue that different types of teamwork rhythms emerge as observable patterns of team processes when teams are tackling a task (Hypothesis 1). Second, different tasks require more or fewer transition and action phases. We therefore hypothesize that the type of task affects the rhythm of teamwork (Hypothesis 2). Third, different team processes are relevant at different times. We therefore assume that the rhythm of teamwork is related to team performance (Hypothesis 3).

4.4 Method

4.4.1 Sample

Ninety-six undergraduate students (71.83% female, mean age = 24.29, $SD = 5.60$) were recruited through campus-wide advertising and were either offered course credits or the chance to win vouchers for an online retailer. Participants were randomly assigned to 48 two-person teams (45.83% female only, 4.17% male only, 50% mixed gender). The teams were videotaped while working on two different tasks, which were assigned consecutively in random order. Due to technical problems (no audio track), two teams had to be excluded for the construction task, resulting in 46 team data sets for this task.

4.4.2 Tasks

The tasks were chosen based on four criteria: (1) they would not impose a certain rhythm or sequence of transition and action processes, (2) transition and action processes would be clearly observable, (3) they required a fairly significant amount of interaction and interdependence between team members (“discretionary task”, Steiner, 1972), and finally (4) the performance of the teams could be measured objectively. We decided on two tasks, which require all the four major task processes included in the McGrath’s circumplex model (1984), namely generating ideas and plans, choosing a solution, negotiating a solution to a conflict, and executing a task. The teams had 30 minutes to complete each task.

Task 1 was to produce a poster about bee mortality for a seminar at the university and is described below as a *creative task*. The teams were instructed to design a poster that was as creative (originality of presentation), informative (amount of information), and aesthetically pleasing (consistent and attractive presentation) as possible. Each performance criterion was equally important. The teams were provided with information about bee mortality, a flipchart, and a range of craft materials (e.g., scissors, glue, colored paper). The information material consisted of five sheets of paper summarizing different aspects of bee mortality (e.g., the consequences). The challenge of the task was that the performance criteria were incompatible; for example, an aesthetically pleasing poster will not contain all the information in order not to appear overloaded.

Task 2, described below as *construction task*, was to use a marble run to construct a model of a roller coaster for a fictitious tender for a leisure park, and was based on Tschan's (2002) "Rolling Ball Task". The teams were instructed to build a marble run with as many crossings and loops as possible; higher scores would be awarded for courses where the marble took as long as possible to finish. The teams had a standard model kit at their disposal, which consisted of two base plates, pillars of different lengths, different track rails, and a variety of connecting pieces. Again, the challenge of the task laid in the incompatibility of the performance criteria; for example, the more loops the marble has to complete, the faster it will run along the track, and it will therefore not take long.

4.4.3 Procedures

For both tasks, the participants sat opposite each other at a table in the middle of a neutral room. On one side of the room was a camera filming the teams. At the beginning of the experiment, declaration of consent and participant information were handed out and signed, and any questions were answered. Participants were then given written instructions for the first randomly selected task, describing the goal and the performance criteria. In addition, they were asked to make all decisions together as a team and to interrupt taskwork when discussing their

strategy with their partner to clarify the distinction between transition and action processes. After any questions had been answered, the materials needed for the first task (e.g., craft materials) were put on the table. The same procedure was followed for the second task. When both tasks had been completed, the participants answered a computer-based questionnaire relating to socio-demographic data.

4.4.4 Measures

4.4.4.1 Team Rhythm

We used an observational method to obtain description of the rhythm of teamwork as data from self-reports are of limited value for understanding the temporal nature of team processes (Kozlowski & Chao, 2018). To provide an initial assessment of the team rhythm, we developed a four-step method, which comprised the coding of team processes (Step 1), and of taskwork (Step 2), because these determine the team rhythm (Marks et al., 2001). Based on this coding, we then determined transition and action phases, defined as clusters of action or transition processes (Step 3). To determine different rhythms statistically, we used four parameters (Step 4), each of which reflected a different aspect of the rhythm of teamwork. The four steps are described in more detail below.

4.4.4.1.1 Step 1: Coding of Team Processes

To code team processes we used the INTERACT software (Mangold, 2017), which allows direct behavioral annotation of video material without requiring verbal transcription. Following the multiple-step procedure for high-quality systematic observational studies set out by Ostrov and Hart (2012), we defined the various team processes in accordance with Marks et al. (2001) and developed a scheme for assigning codes to individual utterances (see Online Supplements). We decided to use sense units (Bales, 1950) to unitize the data. These were coded by two raters who regularly discussed their procedure (cf. Waller & Kaplan, 2016). Next, we trained three independent raters and let them code four videos independently, after which they

discussed their coding. After minor adjustments had been made to the coding scheme, the remaining videos were then coded. In line with the recommendations of Bakeman et al. (2005), eight teams were coded twice for each task to ensure the reliability of the coding. The Krippendorff's alpha was .71 for both tasks, considered as sufficiently high (cf. Krippendorff, 2004).

4.4.4.1.2 Step 2: Coding of Taskwork

When coding the taskwork we followed the same procedure as in Step 1. We defined taskwork in accordance with Marks et al. (2001) and developed a coding scheme (see Online Supplements). We decided to use activity-focused state sequence recording (Bales, 1950; Kaufeld & Meineke, 2018) to assess the duration and timing of each team's taskwork. The training and rating process was applied in the same way as Step 1. Since two coders cannot cut a video at the exact same nanosecond, no reliability values were calculated (cf. Lehmann-Willenbrock & Allen, 2018). For this reason, we developed a detailed and unambiguous coding scheme, which was also continuously expanded during the coding process to make it as exhaustive as possible.

4.4.4.1.3 Step 3: Classification of the Transition and Action Phases

To classify transition and action phases, the codings from the first two steps were merged using INTERACT. This procedure resulted in a timeline for each team, in which one of the following four codes was assigned to each frame of the video: pause (no team process + no taskwork), transition process (transition process + no taskwork), overlap (transition process + taskwork) and action process (action process + taskwork/no taskwork).

Approximately half of the team videos relating to each task (creative task: 62.5%, construction task: 48%) were then classified into transition and action phases by three experts in work and organizational psychology. For this purpose, the codes were displayed as a timeline using INTERACT (see Online Supplements). Clusters of transition or action processes were combined into a transition phase or an action phase. To determine objective rules for classifying

the video frames we used a two-step procedure (cf. Rourke & Anderson, 2004; Weingart et al., 2004). In Step 1, experts examined the timelines and team videos of one quarter of the dataset and set out rules for how the phases should be classified. In Step 2, they then reached consensus on these rules and applied them to the overall data set. For example, the minimum duration of a phase was set at 20 seconds and frames coded as pauses or overlaps were included in these phases.¹⁰ Consequently, breaks between phases were not coded, as these are not expected to occur in short 30-minute tasks.

The expert judgments were then used to classify all the team videos using a custom program written in the R programming language (R Developmental Core Team, 2019). In the first stage, the algorithm used the encoding of the video to assign a specific value to every coded frame (pause = 0, transition = 1, overlap = 2, action = 3). This representation, similar to a time series, was subsequently filtered with a Gaussian moving average to obtain the overall trend, a technique often used in noise-rich problems such as functional magnetic resonance imaging (e.g., Wink & Roerdink, 2004). Next, a cutoff value was used to classify every individual frame as either transition (under 2) or action (at least 2). The classification of the frames was then compared to the experts' judgment by calculating the Krippendorff's alpha for each team task. The classification was finally improved by changing the values assigned to the pause and overlap frames as well as the number of frames included in the Gaussian smoothing to values that improved the lowest inter-rater reliability of the last run. The algorithm terminated this process after 15 runs, resulting in a satisfactorily high inter-rater reliability ($\alpha = .89$) for all frames between the algorithmic solution and the expert judgments. Step 3 results in a graphic representation of the rhythm of teamwork for each team (see Online Supplements).

¹⁰ The experts agreed on this length because, on the one hand, the teams had sufficient time in this period to plan or carry out an action and the phases did not have to be divided into a series of short processes. On the other hand, it was also not too long, so even rapid changes of phase could be detected.

4.4.4.1.4 Step 4: Determination of Rhythm Parameters

Four parameters were determined that reflect different characteristics of the team rhythm according to our earlier definition. We refer mainly to the frequency and duration of transition and action phases, largely ignoring the timing and sequence. Timing is of less importance in a short-term task as there are unlikely to be any breaks in a team's work on the task. Consequently, the sequence is meaningless when there are only two types of phase. We also considered how transition and action phases were related to each other to be an important property of the rhythm of teamwork.

Tempo. The mean value of the duration of the aggregate of each action and the previous transition phase (a 'transition-action unit') in seconds was used to describe the tempo of the rhythm. High values indicate long transition-action units and a slow rhythm, and low values indicate short transition-action units and a fast rhythm.

Regularity of Tempo. The standard deviation of the tempo measure was used to describe the regularity of the rhythm. Low values indicate transition-action units of equal length and thus a regular rhythm, while high values indicate an irregular rhythm. By considering the transition-action units and not individual transition and action phases, rhythms can also be identified as regular if they have different long transition and action phases (see the Online Supplements for a graphic illustration).

Focus. The focus of the rhythm is defined as the median¹¹ of the ratio of the duration of transition phase to action phase in seconds. Values above 1 indicate a focus on transition phases; values below 1 indicate a focus on action phases.

Variability of Focus. The variability of the focus is defined as the standard deviation of the focus measure (cf. Houben et al., 2015). Large values indicate a high degree of variability.

¹¹ Due to outliers (often observed at the beginning of the tasks) we decided to use the median instead of the mean.

4.4.4.2 Team Performance

Team performance for the creative task was independently assessed by three raters on a scale ranging from 1 (very badly) to 5 (very well) using three criteria (information content, aesthetics, and creativity). As the Krippendorff's alpha ranged between .59 and .98, the agreement between raters is considered largely acceptable (Krippendorff, 2004). These performance values were then averaged to obtain one performance parameter per team ($M = 3.78$, $SD = 0.55$, range: 2.44 to 4.67).

For the construction task, the team performance reflects the score achieved by the teams, with a high score indicating a good performance. Similar to the scoring scheme used by Tschan (2002), the teams received ten points for each loop completed, five points for each crossing the marble passed through, and three points for each full second it took to reach the end of the run. The points were recorded by the test supervisor directly at the end of the teamwork ($M = 43.37$, $SD = 29.75$, range: 3 to 129). For this purpose, the run was tested three times and the best result was used.

4.4.5 Data Analysis

To explore whether different types of rhythm emerge as observable team process patterns when teams are undertaking tasks (Hypothesis 1) latent profile analysis (Ferguson et al., 2020) was carried out for both tasks using the robust maximum likelihood estimator in Mplus 8.3 (Muthén & Muthén, 1998–2019). We estimated the 50 best of 1,000 random starts with 50 iterations and checked whether the results were sensitive to the number of random starts for the k profile model. To determine the number of profiles, we used the Akaike information criterion (AIC), the Bayesian information criteria (BIC), the sample-size-adjusted BIC (SSBIC), the bootstrapped likelihood ratio test (BLRT), and the Lo–Mendell–Rubin adjusted likelihood ratio test (LMR-LRT). Profiles that represented less than 5% of the sample were considered unacceptable (cf. Ferguson et al., 2020).

To explore whether the type of task affects the team rhythm (Hypothesis 2), we compared the profile solutions for the creative task and the construction task in terms of the number of profiles and their similarity in terms of profile patterns. In addition, we investigated whether teams adopted the same rhythm of teamwork across tasks. To explore whether team rhythm is related to team performance (Hypothesis 3), we computed pairwise Wald chi-square tests to detect significant differences between the various profiles on team performance (Asparouhov & Muthén, 2014).

4.5 Results

Means, standard deviations, and bivariate correlations are displayed in Table 4.1. Hypothesis 1, which assumed that different types of rhythm would emerge as observable team process patterns during team task accomplishment, was supported. As shown in Table 4.2, for the creative task a three-profile solution was found to have the best fit to the data. For the construction task, a four-profile solution was considered most appropriate in terms of fit indices, but the additional profile was more difficult to interpret in terms of content (e.g., a particular slow rhythm). Therefore, we preferred the three-profile solution for the construction task. For both tasks, profiles can be described as *slow and action-oriented rhythm* (Profile 1), *fast and regular rhythm* (Profile 2), and *changing-focus rhythm* (Profile 3).

Table 4.1*Means, Standard Deviations, and Correlations*

Measure	Creative task		Construction task		1	2	3	4	5	6
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>						
1. Tempo	617.58	406.46	591.73	383.62	—	-.02	-.53*	-.34*	.17	.09
2. Regularity	280.22	202.14	340.36	245.43	-.17	—	.34*	-.01	-.04	-.11
3. Focus	0.53	0.53	0.29	0.23	-.05	-.09	—	.34*	-.04	-.33*
4. Variability in focus	1.57	2.45	0.62	0.79	-.26	-.04	.08	—	-.10	-.22
5. Team performance	3.80	0.50	42.15	29.46	-.01	.07	-.18	-.35	—	.03
6. Order of tasks ^a	1.50	0.51	1.52	0.51	-.17	-.19	.15	.23	-.27	—

Notes. For creative task: $N = 48$ teams ($N = 96$ participants). Correlations are above the diagonal. For construction task: $N = 46$ teams

($N = 92$ participants). Correlations are below the diagonal. ^a 1 = creative task, construction task, 2 = construction task, creative task. * $p < .05$ (two-tailed).

Table 4.2*Fit Indices, Proportions, and Parameters of the Latent Profile Analyses*

	Creative task				Construction task			
	Profile 1	Profile 2	Profile 3	Profile 4 ^a	Profile 1	Profile 2	Profile 3	Profile 4
<i>Fit indices</i>								
AIC	1668.90	1571.58	1537.12	–	1428.83	1324.39	1215.05	1116.60
BIC	1683.87	1603.39	1585.77	–	1443.45	1355.48	1262.60	1180.61
SSBIC	1658.77	1550.06	1504.20	–	1418.37	1302.18	1181.07	1070.86
Entropy	–	0.81	0.89	0.53	–	0.83	0.93	0.98
LRT <i>p</i> value	–	<.001	<.05	–	–	<.05	<.05	<.05
BLRT <i>p</i> value	–	<.001	<.001 ^b	–	–	<.001	<.001	<.001
<i>Profile counts</i>								
1	48	24	13	16	46	16	14	13
2	–	24	30	13	–	30	21	11
3	–	–	5	14	–	–	11	11
4	–	–	–	5	–	–	–	11

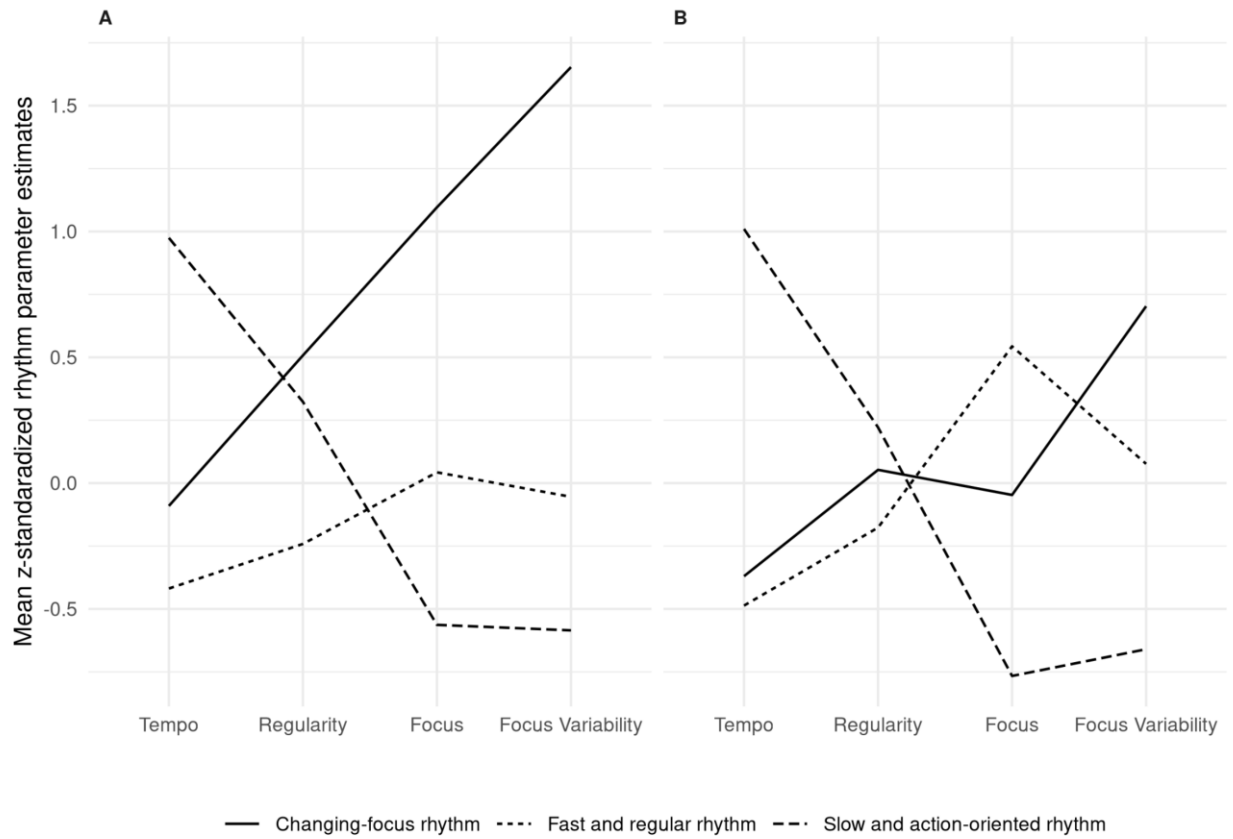
Note. $N_{\text{creative task}} = 48$. $N_{\text{construction task}} = 46$. AIC = Akaike information criterion; BIC = Bayesian information criterion; SSBIC = sample-size-adjusted Bayesian information criterion; LRT = Lo–Mendell–Rubin test; BLRT = bootstrap likelihood ratio test.

^a Not all fit values are displayed, because the model estimation did not terminate normally.

^b The *p* value may not be trustworthy due to convergence issues.

Hypothesis 2 predicted that the type of task would affect the team rhythm. Figure 4.1 plots the average scores on the rhythm parameters. The latent profiles were similar for both profiles. However, while in the creative task teams with a *fast and regular rhythm* showed the most transition phases, in the construction task teams with a *changing-focus rhythm* showed the most transition phases (see Table 4.3). Examining the most likely assignment of each team to the various combinations of profiles reveals that 63.04% of the teams switched their rhythm profile over time (e.g., from a *fast and regular rhythm* in the creative task to a *changing-focus rhythm* in the construction task). Overall, the results thus support the hypothesis.

Hypothesis 3, which predicted that the team rhythm would be related to team performance, received partial support. Performance values were *z*-standardized for ease of comparison between the tasks. For the creative task, the results of the overall Wald chi-square test yielded marginally significant differences between profiles in terms of performance ($\chi^2 = 5.87$, $df = 2$, $p < .10$). Profile membership predicted team performance, so that teams with a *slow and action-oriented rhythm* ($M = 0.18$, $SE = 0.24$, $\chi^2 = 3.53$, $p < .10$) and a *fast and regular rhythm* ($M = 0.98$, $SE = 0.22$, $\chi^2 = 4.51$, $p < .05$) demonstrated marginally significant higher performance than those with a *changing-focus rhythm* ($M = -0.55$, $SE = 0.19$). To ease interpretation, we calculated Hedges *g* effect sizes for pairwise comparisons, which resulted in a medium effect ($g = 0.25$) for a *slow and action-oriented rhythm* and a large effect ($g = 0.48$) for a *fast and regular rhythm* compared to a *changing-focus rhythm* (Bosco et al., 2015). For the construction task, the results of the overall Wald chi-square test yielded no significant differences in performance between profiles ($\chi^2 = 0.09$, $df = 2$, *ns.*).

Figure 4.1*Latent Rhythm Profiles*

Note. A = Creative task, B = Construction task.

Table 4.3*Three-Profile Model Results*

Latent profile	% of sample	Tempo		Regularity		Focus		Focus variability	
		Estimate	<i>SD</i>	Estimate	<i>SD</i>	Estimate	<i>SD</i>	Estimate	<i>SD</i>
<i>Creative task</i>									
Slow and action-oriented rhythm	27.08	1013.69	178.67	345.52	90.62	0.02	0.06	0.14	0.06
Fast and regular rhythm	62.50	447.34	38.03	231.37	38.03	0.56	0.08	1.43	0.21
Changing-focus rhythm	10.42	580.71	124.26	382.81	60.12	1.11	0.43	5.61	2.00
<i>Construction task</i>									
Slow and action-oriented rhythm	30.44	979.13	182.39	394.69	96.89	0.12	0.03	0.09	0.04
Fast and regular rhythm	45.66	405.02	42.65	296.99	44.45	0.41	0.07	0.68	0.13
Changing-focus rhythm	23.91	449.84	0.04	353.29	33.59	0.28	0.04	0.14	0.37

Note. $N_{\text{creative task}} = 48$. $N_{\text{construction task}} = 46$.

4.6 Discussion

The aim of the present study was to advance our understanding of the rhythm of teamwork. Therefore, we empirically captured the rhythm of teamwork (Marks et al., 2001) for the first time and assessed some central assumptions regarding its form, its dependence on the type of task, and its relation to team performance. We developed a method to describe the rhythm of teamwork based on four rhythm parameters: tempo, regularity, focus, and focus variability. Our findings largely support the assumptions made by Marks et al. (2001) that teams show different types of rhythm of teamwork, that the type of rhythm varies depending on the task, and that the type of rhythm is partially related to team performance.

First, the results of our study show that different types of the rhythm of teamwork emerge as observable team process patterns. They enable us to confirm empirically for the first time the central assumption in the recurring phase model, namely that teams show a rhythm of teamwork as cyclical sequences of transition and action phases while working on a task. Remarkably, we identified three types of rhythm—*slow and action-oriented*, *fast and regular*, and *changing-focus*—across both tasks, which suggests that these results could be generalized.

Across both tasks, teams most often used the *fast and regular rhythm*, consisting of many short transition-action units of equal length with a focus on action phases. Teams that show this rhythm were able to adapt quickly to changing environmental conditions (Baard et al., 2014). Accordingly, they do not develop a sophisticated plan for how to complete the task at the beginning of the process but instead continually adapt their way of working through in-process planning (Weingart, 2006). Our findings also illustrate that teams frequently showed a *slow and action-oriented rhythm*, consisting of a few but long transition-action units with a strong but a less adjustable focus on action phases. Teams with such a rhythm can be described as energetic, as they do not plan their actions in detail or with a strategic focus ahead of time but instead execute them immediately (Hackman et al., 1976). These teams employ only the

bare minimum of transition processes and act on a trial and error basis (Rerup & Feldman, 2011), with no deep reflection on their own processes. Only a few teams showed a *changing-focus rhythm*, which is characterized by high variability in focus. Those teams discuss their goals, course of action, and task specifications irregularly but thoroughly, giving them room to focus on the actual task for extended periods of time (cf. Maznevski & Chudoba, 2000). Transition phases appear not to occur at regular intervals but only as needed.

A second main finding of our study is that the rhythm of teamwork varies with the type of task. Although our findings show the same number of rhythm types for both tasks, which are similar on the level of content, more than half of the teams change rhythm types between the tasks. This is in line with the assumption made by Marks et al. (2001) that different tasks require different amounts of transition/action phases, and that this should then be reflected in the rhythm of teamwork. Our findings are also consistent with previous studies, which showed that whether transition processes such as team planning occur is dependent on the characteristics of a task—for example, challenging goals, the importance of the task, or time pressure (Smith et al., 1990; Oldeweme et al., 2021). Future research should examine more closely what task characteristics influence a team's rhythm.

Finally, the results of our study show that the rhythm of teamwork is related to team performance. However, these results are inconclusive because of divergent results in the construction task. In the creative task, teams whose rhythm was *slow and action-oriented* or *fast and regular* showed better performance than those with a *changing-focus rhythm*. It can be concluded that a changing-focus rhythm indicates non-ideal task processing, because irregular and long transition phases are used to constantly revisiting and reexamining goals and strategies which results in a sense of uncertainty and hesitation. Combined with a focus on transition processes, this seems to distract teams from their actual work on the task. The medium to large effects emphasize the substantial variance between the different rhythms of teamwork and thus highlight the practical significance of the results. Moreover, our findings are in accordance with

the assumption made by Marks et al. (2001) that different tasks require more or fewer transition and action phases and that teamwork with a task-appropriate rhythm should result in better team performance. Consequently, team performance does not depend only on which team processes are undertaken but also at which point in time these processes are taken place as already indicated by previous studies that have reported on the relations between different temporal dimensions of team interactions and team performance (e.g., Kennedy & McComb, 2014; Tschan, 2002).

Overall, examining the rhythm of teamwork opens up a new field of research that is distinctly different from previous approaches used to investigate team processes and team dynamics. While the main focus so far has been on examining separate team processes over time such as reflection trajectories (Konradt & Eckardt, 2016) or on using single temporal measures such as timing (Kennedy & McComb, 2014), focusing on the rhythm of teamwork allows us to gain a more comprehensive view of the close links between different team processes. These can be depicted as a complex temporal pattern of process groups that could not be achieved using previous approaches involving other forms of analysis. Another benefit of our rhythm measure is that relatively complex dynamics can be captured in a simple way, enabling us to gain a much better understanding of the interdependencies between different factors as well as offering some practical applications. For example, our findings show that for the creative task a focus on action processes was advantageous. Consequently, popular interventions such as targeted consultative coaching (Hackman & Wageman, 2005), which promote longer transition phases, ought to be avoided for creative tasks. Rather, teams should be encouraged to adopt a *fast and regular rhythm*. For example, with the help of simple interventions (e.g., ‘Stop and think’; Okhuysen, 2001) they could be encouraged to engage in short periods of transitions processes at regular intervals. In addition, as it is assumed that the effectiveness of different types of rhythm depends on the task itself (Marks et al., 2001), it might be beneficial to make teams aware of the importance of different rhythms of teamwork and to train them in these rhythms. They would then

experience less of a cognitive burden when undertaking a task (Hacker, 2005), as they would not have to think about which processes (transition vs. action) are particularly relevant at which point in time. Rather, they could then choose from a portfolio of different rhythms that would provide them with a fixed structure. This would enable teams to focus their attention more specifically on the particular task and thus on a narrower spectrum of different team processes, which in turn should lead to fewer process losses in the team (Steiner, 1972).

4.6.1 Limitations and Directions for Future Research

As with any study, our study has a number of limitations that suggest a need for further research. First, we specified a phase length of at least 20 minutes, as we judged this to be long enough to carry out planning or an action but not too short to mean that the separation of phases was artificial. Even though our specification is based on a multi-step and well-reasoned process (cf. Rourke & Anderson, 2004), future studies should investigate whether our chosen length of phase could be used in other contexts by observing the rhythm of teamwork across different types of task (McGrath, 1984) and settings that involve different types of teams (cf. Marks et al. 2001). A second limitation is that we investigated teams' execution of two separate short-term tasks; this meant that we did not expect there to be any breaks, as included in the recurring phase model, and we thus not consider these when modeling the rhythm of teamwork. Because this applies in particular to long-term tasks that form an essential part of many teams' work, future research should include breaks in the rhythm measure. Additional parameters might be included to measure the rhythm in terms of the frequency, duration, and regularity of breaks. Third, we did not consider the two rhythm characteristics of timing and sequence (cf. Aguinis & Bakker, 2020) because they are insignificant if—as is the case here—there are only two types of phases (transition and action phases) without any breaks. Future research should extend our method by including breaks and consequently using additional parameters to describe the timing and sequence of the rhythm of teamwork. Then, for example, one could consider the frequency of transition-action units that are interrupted by breaks. Finally, the design of our study

has a number of methodological limitations, including the laboratory setting, the use of ad-hoc student teams, and the small sample. All of these factors limit the external validity of the study (e.g., Greenberg & Tomlinson, 2004). However, the aim of this study was not to achieve the highest possible external validity but instead to investigate for the first time whether a rhythm of teamwork can generally be observed and whether this rhythm is related in any way to the type of task or to team performance.

4.6.2 Conclusion

Our study provides a method for capturing the rhythm of teamwork, which is based on the widely used recurring phase model, as well as some initial empirical findings. We identified three different types of rhythm and showed that the rhythm was dependent on the type of task and—specifically for a creative task—was related to team performance. By helping to open up this line of research, this study advances theoretical and empirical understanding of the role of the rhythm of teamwork.

4.7 References

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4.8 Online Supplement

4.8.1 Authors' note

This online supplement accompanies our study of the rhythm of teamwork. It provides additional information on the content analysis, computational methods, and additional results in tables and figures.

4.8.2 Comprehensive Method Description

This online supplement outlines the methodological steps taken to capture the rhythm of teamwork. The newly developed four-step method is based on observational behavioral data and includes the coding of team processes (Step 1) and of taskwork (Step 2) that determine the rhythm of teamwork (Marks et al., 2001). Then, we determined transition and action phases based on clusters of transition or action processes using a custom algorithm (Step 3). Finally, we described the rhythm of teamwork for each team by using four parameters that reflect different characteristics of rhythm (Step 4). The reasons for our methodological decisions and a brief overview are given in the methods section of the article. Additional details and figures are included in this online supplement.

4.8.2.1 Step 1: Coding of Team Processes

To code team processes we used the INTERACT software (Mangold, 2017), which allows direct behavioral annotation of video material without requiring verbal transcription. Following the multiple-step procedure for high-quality systematic observational studies set out by Ostrov and Hart (2012), we defined the various team processes in accordance with Marks et al. (2001) and developed a scheme for assigning codes to individual utterances (see Table 4.4). We decided to use sense units (Bales, 1950) to unitize the data (see Meinecke & Kauffeld, 2016, for details of unitizing rules). Sense units are defined as completed thought, according to which a sentence uttered by the same speaker can contain more than one sense unit (Klonek & Kauffeld, 2012). In the study, pauses in conversation of at least two seconds were also coded as

sense units in order to display pauses between team processes correctly. Two coders classified the sense units and met regularly to compare their results, discuss discrepancies, and decide on the final coding procedure. This approach was intended to ensure high interrater reliability. Next, we trained three raters (including one of the authors), and let them code four videos independently, after which they discussed their coding. After minor adjustments to the specifications of the coding scheme, coding of all the remaining videos was carried out. Table 4.5 shows part of the transcript, with the position numbers of messages given as an example of the coding process, in addition to the communication strings of codes and the verbal messages that were coded.

To ensure the reliability of the coding, eight teams were coded twice for each task. This is in line with the recommendations of Bakeman et al. (2005), which state that at least 15% of the material should be independently coded twice. The Krippendorff's alpha was .71 for both tasks, considered as sufficiently high (cf. Krippendorff, 2004). The results of Step 1 can be used to generate a graphical representation of the team processes for each team (see Figure 4.2 for an example).

Table 4.4*Code, Content Definition, and Example Message*

Code	Short content definition	Example message
Transitions processes		
Mission analysis	Interpretation of the task and identification of team resources	“Yes, and other than that, I’m not quite sure what these plugs are used for.”
Goal specification	Identification and prioritization of goals and sub-goals to accomplish the mission	“So you want to build a really slow track with lots of crossings.”
Strategy formulation	Development of alternative courses of action to accomplish the mission	“Well, it probably makes sense to start at the top.”
Action processes		
Monitoring progress toward goals	Tracking task and progress toward the mission	“The marble comes through—that’s all that matters!”
System monitoring	Tracking team resources and environmental conditions	“Because we don’t have that much time either.”
Team monitoring and backup behavior	Assisting team members to perform their tasks	“Can you slide it [track rail] in up here?”
Coordination	Orchestrating the sequence and timing of interdependent actions	“Hold on a second.”
No team process		
Pause	Pause in conversation or no codable team process	“What did you do over the semester break?”

Note. The entire coding scheme is available from the corresponding author upon request.

Table 4.5*Coding Example for the Construction Task*

Position	Code	Message
1	no team process	<i>Pause</i>
2	strategy formulation	Have you already thought of any idea/approach?
3	strategy formulation	Anything?
4	no team process	<i>Pause</i>
5	strategy formulation	Yes!
6	mission analysis	So, I was looking at the points, and loops give a lot of points.
7	strategy formulation	But I think they are also quite difficult...
8	strategy formulation	...difficult to build, I have also already considered that, yes.
9	no team process	<i>Pause</i>
10	goal specification	So we can try to build one in in any case.
11	goal specification	Exactly!
12	goal specification	And actually, look that we do not build on it, but perhaps rather on a kind of crossing.
13	goal specification	Yes...
14	no team process	<i>Pause</i>
15	goal specification	...and focus on time.
16	goal specification	Yes, exactly!
17	goal specification	Crossing and time.
18	goal specification	Yeah, okay.
19	strategy formulation	And then, I don't know, if we start with a higher one first, but also not so that it is very high?
20	strategy formulation	Mhh.
21	strategy formulation	Or... yes, no idea.
22	strategy formulation	Difficult.
23	strategy formulation	Maybe we could visualize what the thing should look like here on the surface.
24	strategy formulation	Mmm.
25	strategy formulation	Maybe start at a corner, so you can use a lot of the space, I would say.
26	strategy formulation	Mmm.
27	strategy formulation	If you start in the middle, it might be more difficult.
28	strategy formulation	That we just pick a corner...
29	strategy formulation	...and then to make as much distance as possible so as to work through?

Figure 4.2

Example Pattern of Team Processes



4.8.2.2 Step 2: Coding of Taskwork

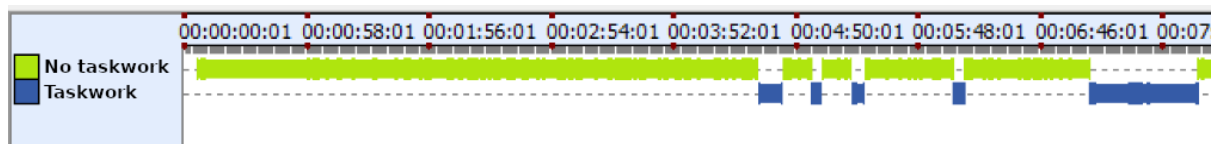
As in Step 1, when coding the taskwork we followed Ostrov and Hart's (2012) multiple-step procedure for high-quality, systematic observational study. We defined taskwork in accordance with Marks et al. (2001) and developed a coding scheme (see Table 4.6).

We decided to use activity-focused state sequence recording (Bales, 1950; Kauffeld & Meineke, 2018) to assess the duration and timing of each team's taskwork. Here anything indicating the presence or absence of a particular activity (in this case taskwork) is coded. We trained three independent raters (the same raters as in Step 1) and let them code five videos independently, after which they discussed their coding. After minor adjustments had been made to the coding scheme, the coding of all the remaining videos was carried out. Since two coders cannot cut a video at the exact same nanosecond, no reliability values were calculated (cf. Lehmann-Willenbrock & Allen, 2017). For this reason, we developed a detailed and unambiguous coding scheme, which was also continuously expanded during the coding process to make it as exhaustive as possible. In total, the coding of taskwork enables us to capture action processes that are not detectable from team communication but from the behavior of the team members. Thus, overlaps between transition and action processes (i.e., taskwork) can also be identified. The results of Step 2 can be used to generate a graphical representation of the pattern of taskwork over time for each team (see Figure 4.3 for an example).

Table 4.6*Codes, Content Definitions, and Example Messages*

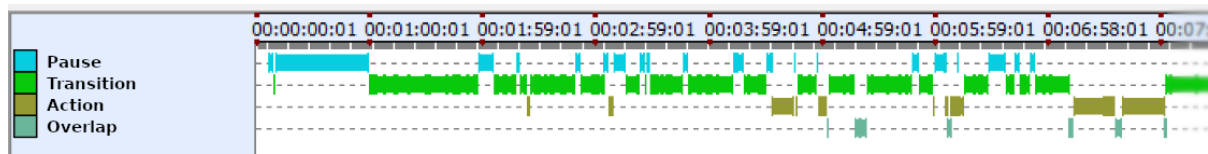
Code	Short content definition	Example message
Taskwork	Activities carried out by the teams	Cutting paper/ plugging together parts of the marble run
No task-work	Covers everything except taskwork	Reading the information material/touching the marble run without building it

Note. The entire coding scheme is available from the corresponding author upon request.

Figure 4.3*Example Pattern of Taskwork*

4.8.2.3 Step 3: Classification of the Transition and Action Phases

To classify transition and action phases, the codings from the first two steps were merged using INTERACT. This procedure resulted in a timeline for each team, in which one of the following four codes was assigned to each frame of the video: pause (no team process + no taskwork), transition process (transition process + no taskwork), overlap (transition process + taskwork) and action process (action process + taskwork/no taskwork). Approximately half of the team videos relating to each task (creative task: 62.5%, construction task: 48%) were then classified into transition and action phases by three experts in work and organizational psychology. For this purpose, the codes were displayed as a timeline using INTERACT (see Figure 4.4).

Figure 4.4*Example Pattern of Team Processes and Taskwork*

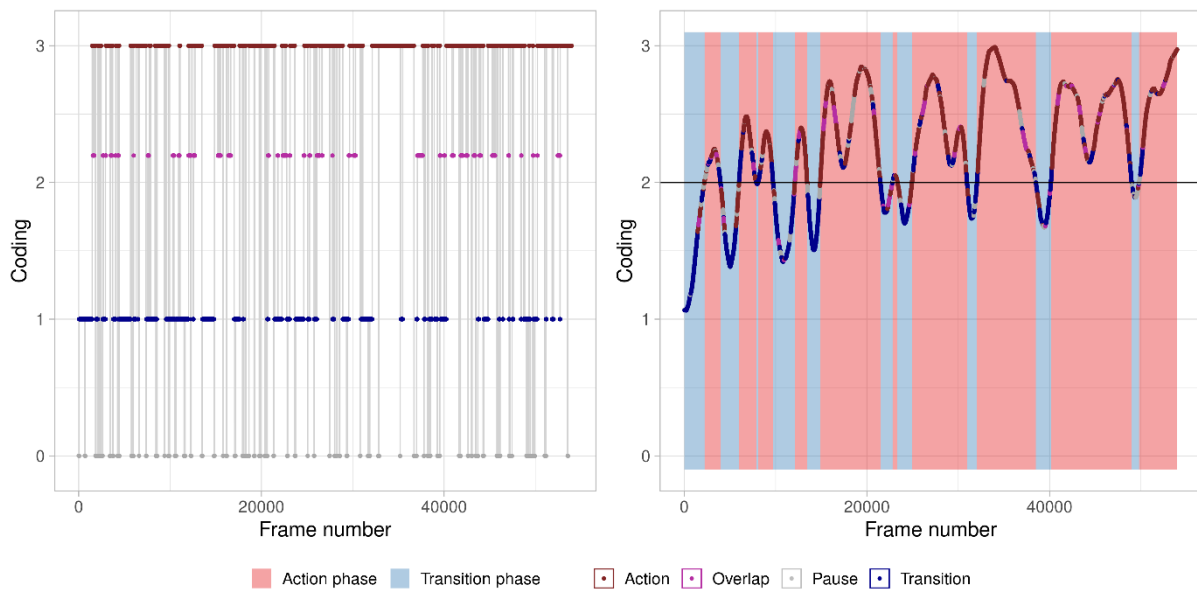
Clusters of transition or action processes were combined into a transition phase or an action phase. To determine objective rules for classifying the video frames we used a two-step procedure. In Step 1, experts examined the timelines and team videos of one quarter of the dataset and set out rules for how the phases should be classified. In Step 2, they then reached consensus on these rules and applied them to the overall data set. For example, the minimum duration of a phase was set at 20 seconds and frames coded as pauses or overlaps were included in these phases. The experts agreed on this length because, on the one hand, it gave teams sufficient time to carry out planning or a specific action and the phases did not have to be divided into a series of short processes. On the other hand, it was also not too long a period, so even rapid changes of phase could be detected. Moreover, at least half of the time had to be assigned to the phase being coded. Frames coded as pauses or overlaps were included in these phases. Frames coded as pauses between transition and action phases are assigned to transition phases and frames coded as overlaps between transition and action phases are assigned to action phases. Consequently, breaks between phases were not coded, as these are not expected to occur in short 30-minute tasks. The two-step procedure we used is in line with the usual procedure for content analysis regarding the repeated modification of the coding scheme (Rourke & Anderson, 2004; Weingart et al., 2004).

The expert judgments were then used to classify all the team videos using a custom program written in the R programming language (R Developmental Core Team, 2019). In the first stage, the algorithm used the encoding of the video to assign a specific value to every coded frame (pause = 0, transition = 1, overlap = 2, action = 3). The initial values for pauses and

overlaps have no meaning. This representation, similar to a time series, was subsequently filtered with a Gaussian moving average to obtain the overall trend, a technique often used in noise-rich problems such as functional magnetic resonance imaging (e.g., Wink & Roerdink, 2004) or image processing (e.g., Deng & Cahill, 1993). One caveat when using such filtering methods is that the outer edges of the data become distorted, since the averaging window centered on the outer points includes areas outside the actual data. One widely used technique, which we also used in our study, is to “pad” the data at both ends with the last n entries of both sides, where n is half the width of the averaging interval. This is a far from perfect solution and leads to averaging artifacts. The closer the edge gets, the less similarity can be seen between the average and the actual data. Since the time-series in our study consisted of at least 36,515 frames for the quickest team and our final averaging window had a total width of 2,500 frames, the maximum of padded data points in our study contained ~6.84% of the frames, which should not affect the results in any major way. Next, a cutoff value was used to classify every individual frame as either transition (under 2) or action (at least 2). Figure 4.5 provides a graphical representation of the data both after coding and after the classification algorithm had been applied.

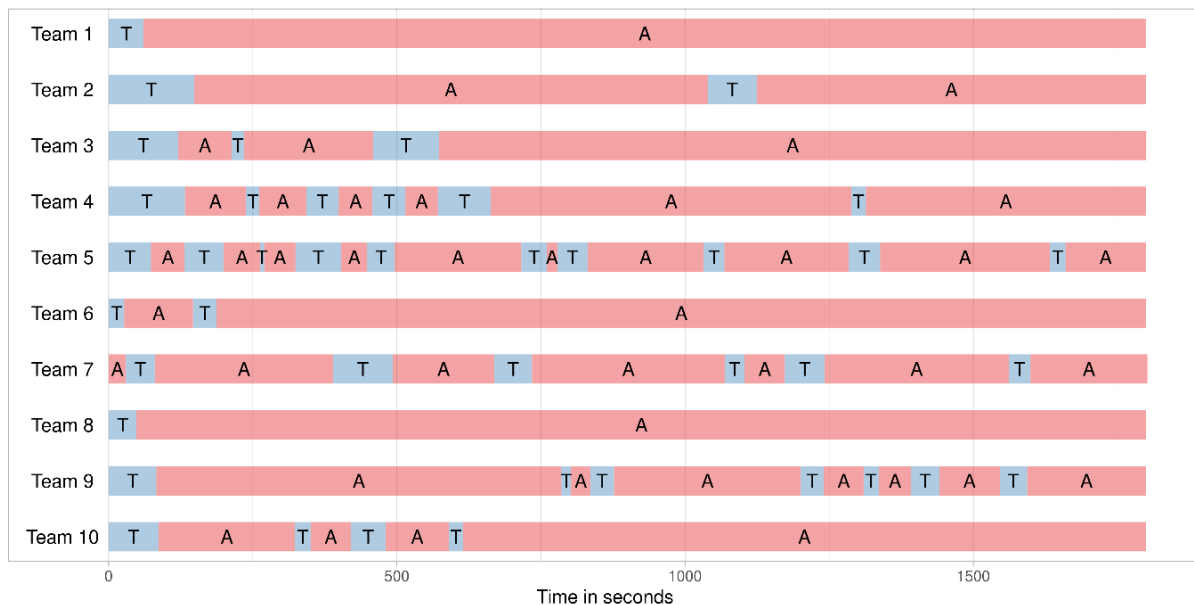
Figure 4.5

Graphical representation of the results achieved by the classification algorithm



Note. On the left are the coding of the individual frames. On the right are the filtered data.

The classification of the frames was then compared to the experts' judgment by calculating the Krippendorff's alpha for each team task. The classification was finally improved by changing the values assigned to the pause and overlap frames as well as the number of frames included in the Gaussian smoothing to values that improved the lowest inter-rater reliability of the last run. The algorithm terminated this process after 15 runs, resulting in a satisfactorily high inter-rater reliability ($\alpha = .89$) for all frames between the algorithmic solution and the expert judgments. Step 3 results in a graphic representation of the rhythm of teamwork for each team (see Figure 4.6).

Figure 4.6*Example of Teamwork Rhythms*

Note. The length of the bars represents the temporal duration of the phases. T = transition phase, A = action phase.

4.8.2.4 Step 4: Determination of Rhythm Parameters

Four parameters were determined that reflect different characteristics of the team rhythm according to our earlier definition. We refer mainly to the frequency and duration of transition and action phases, largely ignoring the timing and sequence. Timing is of less importance in a short-term task as there are unlikely to be any breaks in a team's work on the task. Consequently, the sequence is meaningless when there are only two types of phase. We also considered how transition and action phases were related to each other to be an important property of the rhythm of teamwork.

4.8.2.4.1 Tempo

The mean value of the duration of the aggregate of each action and the previous transition phase (a 'transition-action unit') in seconds was used to describe the tempo of the rhythm.

High values indicate long transition-action units and a slow rhythm, and low values indicate short transition-action units and a fast rhythm.

4.8.2.4.2 Regularity

The standard deviation of the tempo measure was used to describe the regularity of the rhythm. Low values indicate transition-action units of equal length and thus a regular rhythm, while high values indicate an irregular rhythm. By considering the transition-action units and not individual transition and action phases, rhythms can also be identified as regular if they have different long transition and action phases (see Figure 4.7).



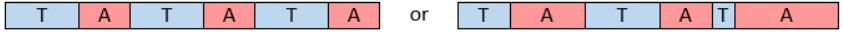
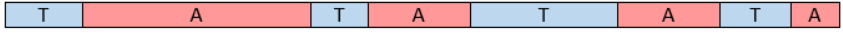



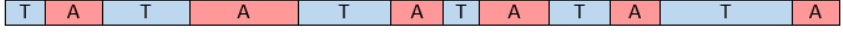
4.8.2.4.3 Focus

The focus of the rhythm is defined as the median^b of the ratio of the duration of transition phase to action phase in seconds. We decided to use the median instead of the mean due to outliers often observed at the beginning of the tasks. Values above 1 indicate a focus on transition phases; values below 1 indicate a focus on action phases.

4.8.2.4.4 Focus Variability

The variability of the focus is defined as the standard deviation of the focus measure. The within-person standard deviation is a measure that is often used to calculate the range of amplitudes across time (e.g., Houben et al., 2015). Large values indicate a high degree of variability.

Figure 4.7*Graphical Presentation of Rhythm Parameters*

Tempo	slow	
	fast	
Regularity	regular	
	irregular	
Focus	transition	
	action	
Focus Variability	low	
	high	

Note. The length of the bars represents the temporal duration of the phases. T = transition phase, A = action phase.

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5 GESAMTDISKUSSION

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Mit dem steigenden Einsatz von Teams in Organisationen wuchs das Forschungsinteresse an Teamprozessen, die sowohl auf theoretischer als auch auf empirischer Ebene als kritischer Faktor der Teamleistung angesehen werden (z.B. Christian et al., 2017; Ilgen et al., 2005; LePine et al., 2008). Dabei diente das Recurring Phase Model of Team Processes von Marks et al. (2001) als theoretische Grundlage für eine Vielzahl von Studien (für einen Überblick siehe McComb & Kennedy, 2020). Im Fokus der vorliegenden Dissertation standen zwei in der Forschung bisher eher vernachlässigte Aspekte dieses Modells: Teamplanen und der Rhythmus der Teamarbeit. Ziel der Dissertation war es, zum einen relevante Teilprozesse des Teamplanungsprozesses zu identifizieren und hinsichtlich ihrer Antezedenzien zu untersuchen und zum anderen den Rhythmus der Teamarbeit als komplexes zeitliches Muster von Teamprozessen erstmals zu erfassen und dessen zentrale Annahmen zu überprüfen. Hierfür wurde in Studie 1 (Kapitel 2) ein neues prozessorientiertes Modell zum Teamplanen aufgestellt, sowie eine entsprechende multidimensionale Skala, eine eindimensionale Kurzform-Skala und eine Ein-Item-Skala entwickelt und validiert. Darauf aufbauend wurden in Studie 2 (Kapitel 3) mithilfe zweier Policy-Capturing Untersuchungen Situationsmerkmale als Antezedenzien des Teamplanens untersucht. Es zeigte sich, dass das Planungsverhalten von Teams abhängig von der Aufgabenroutine, dem Zeitdruck und der Folgeschwere der Entscheidungen ist. In Studie 3 (Kapitel 4) wurde schließlich der Frage nachgegangen, ob Teams beim Bearbeiten einer Aufgabe einen Rhythmus der Teamarbeit als Muster von Transitions- und Aktionsprozessen zeigen und wie dieser erfasst werden kann. Dabei konnten drei unterschiedliche Typen des Rhythmus der Teamarbeit identifiziert werden, die teils in Zusammenhang mit der Teilleistung stehen. Zudem zeigte sich, dass Teams ihren Rhythmus der zu bearbeitenden Aufgabe (kreative Aufgabe vs. Konstruktionsaufgabe) anpassen.

Im Folgenden werden die Ergebnisse und Erkenntnisse der drei Studien zusammengefasst und in die bestehende Literatur eingeordnet. Anschließend erfolgt eine kritische Bewertung der Dissertation und Implikationen für die Forschung und Praxis werden dargelegt.

5.1 Zusammenfassung der Ergebnisse

Entsprechend der Zielsetzung der vorliegenden Dissertation werden zunächst die Befunde von Studie 1 und 2 zum Konstrukt des Teamplanens dargelegt. Anschließend werden die Ergebnisse der dritten Studie zum Rhythmus der Teamarbeit erläutert.

5.1.1 Teamplanen

Teamplanen wird nicht nur im Rahmen des Recurring Phase Models of Team Processes (Marks et al., 2001) als relevanter Teamprozess betrachtet, sondern auch darüber hinaus als entscheidender Faktor für die Leistung von Teams und Organisationen angesehen (Mumford et al., 2015; West, 2000). Trotz dieser bereits empirisch belegten Annahme (z.B. Fisher, 2014; Mehta et al., 2009) wurde Teamplanen im Vergleich zu anderen Teamprozessen wie Reflexion (Konradt et al., 2015; Moreland & McMinn, 2010) oder Adaptation (Baard et al., 2014) vergleichsweise wenig betrachtet. Bislang fehlt eine vollständige Darstellung des Teamplanungsprozesses mit seinen verschiedenen Elementen, Antezedenzen und Konsequenzen (vgl. Mumford et al., 2001).

Mit dem Ziel, die relevanten Teilprozesse des Teamplanens zu identifizieren, wurde in Studie 1 ein Modell zum Teamplanen entwickelt, in dem die vier Dimensionen Exploration, Strategisches Planen, Detailplanen und Prognose unterschieden werden. Im Gegensatz zu bestehenden Planungsmodellen (Hacker, 2005; Dörner 2016; Mumford et al., 2015) liegt der Fokus in dem postulierten Modell auf den relevanten *Teamplanungsprozessen* und ihre unterschiedlichen *Funktionen* in Bezug auf die Zielerreichung. Dies ist insofern vorteilhaft, als dass damit eine von der genauen Art des Geplanten losgelöste und universell einsetzbare Konzeptualisierung der Planung erfolgt. Das vorliegende prozessorientierte Modell grenzt sich durch

seinen deskriptiven Ansatz darüber hinaus von den existierenden normativen Modellen ab (z.B. Dörner, 2016; Mumford et al., 2015). Statt von einer festgelegten und idealen Abfolge von Planungsprozessen und damit auch von seriellen Abhängigkeiten zwischen diesen Prozessen auszugehen, können die einzelnen Planungsprozesse somit weitaus detaillierter und voneinander losgelöst untersucht werden.

Die postulierte vierdimensionale Struktur des Modells konnte bereits im Rahmen der Entwicklung und Validierung der multidimensionalen Skala durch insgesamt vier Stichproben in Studie 1 und 2 gestützt werden. Die vier Planungsdimensionen sind dabei aufgrund ihrer Interkorrelationen zwar aufeinander bezogen, aber ebenso eindeutig faktoranalytisch voneinander zu trennen. Daher ist davon auszugehen, dass die Komplexität und Vielfalt der beteiligten Verhaltensweisen im Teamplanungsprozess von den in der bisherigen Forschung häufig verwendeten eindimensionalen Ansätzen (z.B. Mehta et al., 2009; Weldon et al., 1991) nur unzureichend erfasst werden kann (vgl. Konradt et al., 2015). Der Vorteil einer multidimensionalen Betrachtungsweise besteht laut Konradt et al. (2015) zudem in der Möglichkeit, verschiedene Arten und Muster eines Teamprozesses unterscheiden zu können. Dadurch kann mithilfe der multidimensionalen Skala ein Kontinuum von Planungsformen (z.B. hinsichtlich der Fokussierung auf eine Planungsdimension) abgebildet und mit unterschiedlichen Ergebnissen (positiv und negativ) in Zusammenhang gebracht werden (vgl. Otte et al., 2018). Dieser Ansatz scheint vor dem Hintergrund bisheriger Befunde, in denen bereits gezeigt werden konnte, dass unterschiedliche Aspekte der Planung (z.B. Zeitplanung) zu unterschiedlichen Ergebnissen (z.B. Ausprägung Teamkoordination) führen (DeChurch & Haas, 2008; Janicik & Bartel, 2003), einen bedeutsamen Erkenntnisgewinn zu ermöglichen.

Zusätzlich wurden in Studie 1 neben der multidimensionalen Skala auch zwei eindimensionale Kurzskalen zum Teamplanen entwickelt. Obwohl eindimensionale Kurzskalen die Komplexität und Vielfalt der beteiligten Verhaltensweisen im Teamplanungsprozess nicht abbilden können, sind diese in bestimmten Untersuchungskontexten (z.B. Tagebuchstudien) nicht

wegzudenken. Darüber hinaus sollten Prädiktor und Kriterium generell im Sinne des klassischen Kompatibilitätsprinzips (Fishbein & Ajzen, 1974) ähnlich spezifisch bzw. allgemein erfasst werden, um deren Zusammenhänge korrekt abzubilden. Im Rahmen der Persönlichkeitsforschung wird dies auch als *bandwidth-fidelity trade-off* ausführlich diskutiert (z.B. Ones & Viswesvaran, 1996). Je nach inhaltlicher Hypothese und Operationalisierung der Studienvariablen ist daher die Anwendung einer eindimensionalen Teamplanenskala zweifellos sinnvoll (vgl. LePine et al., 2008). Bisherige eindimensionale Teamplanenskalen wurden allerdings ohne vorherige Validierung eingesetzt (van der Kleij et al., 2009; Mehta et al., 2009; Smith et al., 1990).¹² Dabei ist die Validität von Skalen als Grundvoraussetzung der intendierten Generalisierung psychologischer Forschung zu betrachten (z.B. American Educational Research Association, 2014; Moosbrugger & Kelava, 2008). Die sorgsame Entwicklung und Validierung einer Kurzsкала sowie eines Single-Items in Studie 1 ist daher entscheidend, um Teamplanen zukünftig auch als allgemeines Konstrukt valide und reliabel erfassen zu können.

Nachdem sowohl relevante Teamplanungsprozesse identifiziert als auch reliable und valide Teamplanenskalen entwickelt wurden, standen in Studie 2 potentielle Antezedenzen des Teamplanungsprozesses im Fokus. Es konnte gezeigt werden, dass die Situationsmerkmale Zeitdruck, Aufgabenroutine und Folgeschwere der Entscheidung Teamplanen beeinflussen. Die Ergebnisse stimmen damit mit Befunden auf der Individualebene überein (für einen Überblick siehe Mumford et al., 2001), in denen ein Zusammenhang zwischen Umgebungsfaktoren und individuellem Planungsverhalten gezeigt werden konnte. Deutlich wird dadurch, wie wichtig die Berücksichtigung von Kontextfaktoren (hier Situationsmerkmale als Antezedenzen) in der Forschung ist und dass diese sowohl in der Theorie als auch in der Praxis stärker berücksichtigt werden sollten.

¹² Eine Ausnahme stellen die kürzlich veröffentlichten eindimensionalen Teamplanenskalen von Mathieu et al. (2020) dar, die zeitlich parallel zur Entstehung dieser Arbeit entwickelt wurden. Während die faktorielle und diskriminante Validität dieser Skalen bestätigt werden konnte, wurde die prädiktive Validität bislang nicht betrachtet.

Zusammenfassend konnte in Studie 1 und 2 damit ein prozessorientiertes Modell zum Teamplanen, eine entsprechende vierdimensionale Skala und zwei Kurzskalen entwickelt und validiert werden. Außerdem konnten in Studie 2 erste Befunde hinsichtlich der Antezedenzen (d.h. Zeitdruck, Aufgabenroutine, Folgeschwere der Entscheidung) berichtet werden. Die Ergebnisse der vorliegenden Dissertation stellen damit eine wichtige Grundlage für weiterführende Theorien und Forschung zum Prozesse des Teamplanens dar.

5.1.2 Rhythmus der Teamarbeit

Im Rahmen des Recurring Phase Model of Team Processes von Marks et al. (2001) wird ein Rhythmus der Teamarbeit definiert. Dieser beschreibt das komplexe zeitliche Muster, bestehend aus Transitionsphasen, Aktionsphasen und Pausen zwischen diesen Phasen, welches sich aus den einzelnen Teamprozessen bei der Aufgabebearbeitung ergibt. In dem Rhythmus der Teamarbeit wird damit sowohl die vielfach theoretisch diskutierte Dynamik von Teamprozessen als auch die enge Verknüpfung einzelner Teamprozesse berücksichtigt (z.B. Ilgen et al., 2005; Kozlowski, 2015; Kozlowski & Chao, 2018). Die ganzheitliche zeitliche Betrachtung der voneinander abhängigen Teamprozesse könnte nicht nur helfen zu verstehen, welche Teamprozesse für die Bewältigung der Aufgabe maßgeblich sind, sondern auch, zu welchem Zeitpunkt sie kritisch sind. Eine empirische Untersuchung des Modells ist bislang jedoch nicht erfolgt.

Mit dem Ziel den Rhythmus der Teamarbeit als komplexes zeitliches Muster von Teamprozessen erstmals empirisch zu erfassen und die zentralen Annahmen von Marks et al. (2001) zu überprüfen, wurde in Studie 3 eine neue vierstufige Methode entwickelt und angewendet. Voraussetzung dafür war eine präzise Definition des Konstruktes Rhythmus, welches von Marks et al. (2001) lediglich als wiederkehrende Abfolge von Transitions- und Aktionsphasen mit unterschiedlicher Dauer und dazwischenliegenden Pausen veranschaulicht wurde. Daher wurde zunächst eine Definition erarbeitet, in der der Rhythmus der Teamarbeit in Anlehnung an Aguinis und Bakker (2020) als die zyklische Abfolge von unterschiedlich vielen Aktions-

und Transitionsphasen definiert wird, wobei die Phasen von unterschiedlicher Dauer mit unterschiedlich langen dazwischenliegenden Pausen sind. Die Ergebnisse von Studie 3 stützen die Annahme von Marks et al. (2001), dass Teams bei der Bearbeitung einer Aufgabe verschiedene Typen des Rhythmus der Teamarbeit aufweisen. Frühere Studien zur Validierung des Modells setzten sich bislang nur mit der postulierten Taxonomie der Teamprozesse (LePine et al., 2008), der Relevanz des Timings dieser Teamprozesse (Kennedy & McComb, 2014) oder Maßen zur Beschreibung der zeitlichen Wiederkehr auseinander („recurrence“; McComb & Kennedy, 2020). Erstmals konnten nun empirische Befunde zum Rhythmus der Teamarbeit gesammelt werden. Über eine kreative Aufgabe und eine Konstruktionsaufgabe hinweg konnten drei vergleichbare Rhythmustypen extrahiert werden. Obwohl diese drei Rhythmustypen nicht erschöpfend sein müssen, weist dies auf eine mögliche Generalisierbarkeit der Rhythmustypen hin. Zudem konnte gezeigt werden, dass Teams keinen inhärent festgelegten Rhythmus besitzen, sondern dieser in Abhängigkeit der Aufgabe variieren kann. Teams scheinen ihren Rhythmus der Aufgabe anzupassen, was im Einklang mit bisherigen Forschungsarbeiten steht, in denen ein Zusammenhang zwischen den Eigenschaften einer Aufgabe und dem Auftreten unterschiedlicher Teamprozesse gezeigt werden konnte (z.B. Smith et al., 1990; Oldeweme et al., 2021; Weingart, 2006). Darüber hinaus konnte zumindest teilweise ein Zusammenhang zwischen dem Teamrhythmus und der Teamleistung gezeigt werden. Während bei der kreativen Aufgabe ein negativer Zusammenhang zwischen der Teamleistung und einem Rhythmus mit wechselndem Fokus (Transition vs. Aktion) belegt werden konnte, ließen sich bei der Konstruktionsaufgabe keine Zusammenhänge zwischen den Rhythmustypen und der Leistung feststellen. Bisherige Forschung konnte ebenfalls Zusammenhänge zwischen unterschiedlichen zeitlichen Maßen der Teaminteraktion (z.B. Dauer, Timing) und der Teamleistung nachweisen (z.B. Kennedy & McComb, 2014; Goh et al., 2013; Lei et al., 2015; Tschan, 1995, 2002).

Indem der Rhythmus der Teamarbeit prägnant definiert und erstmals empirisch erfasst werden konnte, eröffnet Studie 3 ein neues Forschungsfeld. Damit fördert die Studie das theoretische und empirische Verständnis bezüglich des Rhythmus der Teamarbeit und seiner Bedeutung. Zusätzlich stellt die Studie eine neue Methodik vor, die es auch zukünftigen Forschern erlaubt, den Rhythmus der Teamarbeit valide und reliabel zu erfassen.

5.2 Kritische Bewertung

Spezifische Stärken und Schwächen der einzelnen Studien wurden bereits in den jeweiligen Kapiteln 2 - 4 diskutiert. An dieser Stelle soll daher übergreifend eine kritische Bewertung der gesamten Dissertation hinsichtlich der Mess- und Analysemethoden sowie der Generalisierbarkeit erfolgen.

5.2.1 Messmethoden

Im Rahmen der vorliegenden Dissertation wurde ein besonderes Augenmerk auf die Messmethoden der zentralen Konstrukte, Teamplänen und Rhythmus der Teamarbeit gelegt. Beide Konstrukte konnten durch die eigens entwickelten Methoden reliabel und valide erfasst werden. Die Erfassung von Teamplänen mithilfe eines Fragebogens kann dabei als besonders praktikabel, ökonomisch und anwenderfreundlich beschrieben werden (Paulhus & Vazire, 2007). Daneben bringt die Anwendung von Fragebogenverfahren allerdings—wie jede Untersuchungsmethode—auch einige Nachteile mit sich. So ist kritisch anzumerken, dass Fragebogenverfahren verschiedene Verzerrungstendenzen wie der sozialen Erwünschtheit, verschiedenen Antworttendenzen und Erinnerungsverzerrungen unterliegen (Beauducel & Leue, 2014; Kline, 2005). Gerade letztere wurden im Kontext des Planens von Frese et al. (2007) als problematisch beschrieben, da Menschen ihren Handlungen im Nachhinein manchmal Pläne zuschreiben, die tatsächlich im Moment der Handlung nicht vorhanden waren. Dies könnte zu Einbußen in der Validität führen und damit auch die Generalisierbarkeit der Ergebnisse einschränken (z.B. American Educational Research Association, 2014; Moosbrugger & Kelava,

2008). Um die Validität der entwickelten Teamplanungsskalen weiter zu untersuchen, sollte daher im Rahmen zukünftiger Forschung ein Vergleich von tatsächlichem Verhalten und Fragebogendaten erfolgen (vgl. Mayring, 2010; Rourke & Anderson, 2004).

Im Gegensatz dazu wurde der Rhythmus der Teamarbeit mithilfe von Beobachtungsdaten erfasst. Die Anwendung einer Gauß-Filterfunktion ermöglichte dabei die Identifikation der zugrundeliegenden Transitions- und Aktionsphasen während eine Latente Profil Analyse die Ermittlung unterschiedlicher Rhythmustypen erlaubte. Der Rhythmus der Teamarbeit setzt sich dabei, gemäß einem formativen Konstrukts (Ellwart & Konradt, 2011), aus den verschiedenen Rhythmusparametern zusammen. Durch die Entscheidung, den Rhythmus der Teamarbeit im Rahmen einer Laborstudie zu untersuchen, wurde jedoch die Komplexität des Konstruktes für eine erste Untersuchung bewusst reduziert (vgl. Klonek et al., 2019). Dies betrifft die Betrachtung einer einzelnen und isolierten Aufgabe als auch die Vernachlässigung von Pausen während der Teamarbeit. Dadurch wurden die Rhythmusparameter des Timings und der Reihenfolge in der vorliegenden Arbeit vernachlässigt. Aufbauend auf den vielversprechenden Ergebnissen der vorliegenden Dissertation sollte im Rahmen zukünftiger Forschung die Komplexität des Konstruktes und damit die Inhaltsvalidität stärker berücksichtigt werden, sodass eine Übertragung der Messmethode auf verschiedene Kontexte ermöglicht werden kann. Die Integration weiterer Rhythmusparameter in die dargestellte Methode kann dabei problemlos erfolgen. Ähnlich wie im Kontext des Teamplanens (vgl. Abschnitt 5.1.1) sollten durch eine möglichst detaillierte Betrachtungsweise dann präzisere Aussagen möglich sein.

5.2.2 Analysemethoden

Bezüglich der verwendeten Analysemethoden lässt sich festhalten, dass im Rahmen der einzelnen Studien angemessene statistische Verfahren ausgewählt und durchgeführt wurden. Dies betrifft (1) die Multigruppen CFA in Studie 1, durch die die Messinvarianz zwischen unterschiedlichen Stichproben betrachtet werden konnte, (2) die Hierarchisch Lineare Modellierung in Studie 2, durch die die genestete Struktur der Daten berücksichtigt werden konnte,

sowie (3) die Kombination einer Gauß-Filterfunktion und Latenten Profil Analysen in Studie 3, durch die die statistische Beschreibung des Rhythmus der Teamarbeit ermöglicht wurde. Einschränkend lässt sich lediglich festhalten, dass die genestete Datenstruktur von Stichprobe C in Studie 1 durch die gewählte Faktorenanalyse auf Individualebene nicht berücksichtigt wurde. Dieses Vorgehen ist im Rahmen der Teamforschung nicht unüblich (z.B. Mathieu et al., 2020; Otte et al., 2016). Allerdings kann ein möglicher Effekt der Teamstruktur bzw. ein Effekt der Interaktion von Individual- und Teamebene so nicht detektiert werden (vgl. Klein & Kozlowski, 2000). Alternativ wäre für die Analyse der Daten daher eine Multilevel Faktorenanalyse denkbar gewesen. Speziell wäre hier aufgrund der Operationalisierung des Konstruktes in Studie 1 sowie der zu beobachteten (nicht vollkommenen) Übereinstimmung der Angaben zum Planen zwischen den Teammitgliedern ein *shared and configural model* angemessen gewesen (Stapleton, Yang & Hancock, 2016). Bei einem derartigen Modell werden sowohl Unterschiede zwischen den Teammitgliedern als auch zwischen den Teams modelliert (Stapleton & Johnson, 2019). Bislang wurde ein solches Modell zur Modellierung empirischer Daten jedoch nicht eingesetzt, was unter anderem durch die fehlende Identifizierbarkeit des Modells unter frequentistischen Analyseverfahren bedingt sein könnte. Zur Berechnung eines solchen Modells müssten weitere Modellannahmen (willkürlich) getroffen werden (siehe Stapleton & Johnson, 2019) oder auf die bayesianische Statistik ausgewichen werden. Letzteres wäre im vorliegenden Fall aufgrund der kleinen Stichprobengröße nur durch die Annahme informativer Priors möglich (McNeish, 2019; Smid et al., 2020). Da sich zeigte, dass die Ergebnisse dabei in Abhängigkeit der Priors stark variieren (vermutlich ebenfalls aufgrund der kleinen Stichprobengröße), ist eine reliable Schätzung der Parameter so nicht möglich gewesen (van Erp et al., 2018). Gleiches gilt aufgrund der kleinen Stichprobengröße für die Parameterschätzungen mit zusätzlichen Modellannahmen im frequentistischen Fall (McNeish & Stapleton, 2016). Daher wurde in der vorliegenden Dissertation auf eine Multilevelanalyse verzichtet.

5.2.3 Generalisierbarkeit

Im Fokus der vorliegenden Dissertation stand die Untersuchung von Teamprozessen. Kritisch ist anzumerken, dass die Ergebnisse von Studie 1 teilweise und die Ergebnisse von Studie 2 vollständig auf der Analyse von Individualdaten beruhen. Obwohl bei der Durchführung in beiden Studien der Teamkontext im Rahmen der Instruktionen (Studie 1) bzw. des Handlungsrahmens (Studie 2) salient war, wurde letztlich die individuelle Wahrnehmung von Teamplänen einzelner Teammitglieder und nicht die des gesamten Teams ermittelt. Dies ist im Rahmen der Teamforschung ein gängiges Verfahren (z.B. Drescher & Garbers, 2016; Johnson et al., 2007; Müller & Antoni, 2020, Otte et al., 2016), da davon ausgegangen wird, dass die Antworten der einzelnen Teammitglieder im Sinne eines *collective* oder *shared construct* in einem hohen Maße übereinstimmen (Morgeson & Hofman, 1999; Stapleton, McNeish & Yang, 2016). Unterschiede zwischen den Antworten der einzelnen Teammitglieder sowie Aspekte der Teaminteraktion oder Teamdynamik, die die Teamleistung und Teamprozesse beeinflussen, konnten so nicht berücksichtigt werden (Mathieu et al., 2008; Stapleton, McNeish & Yang, 2016). Zudem wurden in Studie 1 und Studie 3 Ad-Hoc-Teams in einem Laborsetting untersucht, um die zentralen Konstrukte der Dissertation zunächst isoliert zu erfassen, die interne Validität zu bewerten und Rückschlüsse auf die Kausalität zu ermöglichen (vgl. Klonek et al., 2019). Im Rahmen zukünftiger Forschung sollte die dadurch möglicherweise eingeschränkte Generalisierbarkeit der Befunde (vgl. Chidambaram & Bostrom, 1997; Greenberg & Tomlinson, 2004) überprüft und die Ergebnisse der vorliegenden Dissertation damit weiter validiert werden.

5.3 Implikationen

Im folgenden Abschnitt werden zunächst theoretische Implikationen der vorliegenden Dissertation dargestellt. Anschließend werden erste praktische Implikationen erläutert.

5.3.1 Theoretische Implikationen

Die vorliegende Dissertation leistet einen wesentlichen Beitrag zur Forschung durch die Entwicklung und Validierung eines prozessorientierten Modells zum Teamplanen. Dabei konnten durch die Zusammenführung der Planungstheorien von Hacker (2005), Mumford et al. (2015) und Dörner (2016) relevante Teamplanungsprozesse identifiziert und hinsichtlich ihrer unterschiedlichen Funktionen in Bezug auf die Zielerreichung differenziert werden. Mithilfe dieser multidimensionalen Betrachtungsweise können neben dem Ausmaß des Teamplanens zukünftig auch ein Fokus und ein Muster bestimmt und somit weitaus spezifischere Hypothesen entwickelt werden. Ähnlich wie in der Reflexionsforschung (Otte et al., 2018) könnte ein Team mit einem sehr starken Fokus auf nur eine Planungsdimension unter Umständen eine bessere Leistung zeigen als ein Team mit einem ausgewogenen Fokus auf allen vier Dimensionen. Des Weiteren könnte ein Muster in Form der Zeitpunkte und Häufigkeit von Wechseln zwischen verschiedenen Teamplanungsprozessen entscheidend für die Teameffektivität sein. Darauf deuten bereits Ergebnisse der Studien von Kennedy und McComb (2014) und Goh et al. (2013) hin, die jedoch übergreifend Teamprozesse und nicht Teamplanungsprozesse betrachteten. Insgesamt kann durch die postulierte multidimensionale Betrachtungsweise somit jedem Team ein eigenes Planungsprofil zugeordnet werden, wodurch es sich besser von anderen Teams unterscheiden lässt und eine genauere Diagnose und gezieltere Interventionen möglich sind. Bedeutsam wird die Möglichkeit dieser weiteren Differenzierung des Teamplanens auch vor dem Hintergrund der kürzlich durchgeführten und noch unveröffentlichten Metaanalyse von Konradt et al. (2021). Die Autoren konnten neben dem postulierten positiven Zusammenhang zwischen Teamplanen und Teamleistung auch eine Subgruppe an Studien mit nicht signifikanten Effektstärken statistisch identifizieren, die mit einer hohen Vertrautheit der Aufgabe einhergeht. Neben weiteren möglichen Situationsfaktoren, die einen nicht signifikanten oder sogar negativen Zusammenhang zwischen Teamplanen und Teamleistung (Lei et al., 2016; Waller, 1999) begünstigen, kann durch die differenzierte Betrachtungsweise von Teamplanen aber auch nach

Ursachen innerhalb des Planungsprozesses gesucht werden. Wie oben skizziert, könnten ein zu hohes Maß an Detailplanung ohne die mentale Überprüfung des Plans (Prognose) oder auch ein Muster aus vielen kurzen Wechseln zwischen den Planungsprozessen mit einem fehlenden positiven oder auch negativen Effekt des Teamplanens in Verbindung stehen.

Darüber hinaus konnte in Studie 2 gezeigt werden, dass Situationsmerkmale als Antezedenzen bzw. Inputfaktoren im Sinne des weitverbreiteten Input-Mediator-Output-Input Modell (IMOI; Ilgen et al, 2005) einen zentralen Einfluss auf Teamplanen als spezifischen Teamprozess nehmen. Aufbauend auf der Handlungsregulationstheorie (Hacker, 2005), der Ressourcenallokationstheorie (Norman & Bobrow, 1975) und der Zielsetzungstheorie (Locke & Latham, 2002) konnte konkret der Effekt von Routine, Zeitdruck und Folgeschwere auf das Planungsverhalten im Team belegt und damit auch das IMOI Modell weiter validiert werden. Die Ergebnisse stützen zudem die Annahme von Tschan (2002) hinsichtlich der Sinnhaftigkeit, Konzepte und Theorien von der individuellen Ebene auf die Teamebene zu übertragen, was einen vielversprechenden Ansatz für zukünftige Forschung bietet. Aufbauend auf den Befunden zu den untersuchten Situationsmerkmalen sollte aber auch die Bedeutung weiterer Faktoren, wie die der Teamzusammensetzung (z.B. Persönlichkeit), Faktoren auf Teamebene (z.B. Teamstruktur) und Faktoren der Organisation bzw. des Kontextes (z.B. kulturelle Einflüsse, Grad der Virtualität) betrachtet und auf theoretischer Ebene integriert werden (vgl. Mathieu et al., 2008). Zudem sollten im Sinne des IMOI Modells auch weitere Outputfaktoren, wie die Zufriedenheit, das Commitment oder Extra-Rollen-Verhalten, berücksichtigt werden. Das sich daraus ergebende nomologische Netzwerk des Teamplanungsprozesses sollte sowohl dessen Verständnis als auch der Ableitung konkreter Interventionen mit dem Ziel der Steigerung der Teameffektivität dienen.

Neben dem spezifischen Prozess des Teamplanens beschäftigte die vorliegende Dissertation sich mit dem von Marks et al. (2001) postuliertem Rhythmus der Teamarbeit, in dem die

Dynamik und Abhängigkeit der verschiedenen Teamprozesse (z.B. Teamplanen, Teamkoordination) berücksichtigt werden. Dabei konnten die zentralen Annahmen von Marks et al. (2001) zum Rhythmus der Teamarbeit erstmals empirisch validiert werden. Durch die Entwicklung einer geeigneten Methode zur Erfassung des Rhythmus der Teamarbeit liefert die vorliegende Arbeit damit ein wichtiges Werkzeug für zukünftige Forschung in diesem Bereich. Konkret stellt sich auf der Grundlage der Ergebnisse die Frage, ob die hier beobachteten Rhythmen auf anderen Aufgabentypen und Kontexte (z.B. virtuelle Teamarbeit) übertragen werden können und ob zudem weitere Typen des Rhythmus existieren. Ebenso gilt es, den beobachteten Zusammenhang zur Teamleistung weiter zu erforschen und zu verstehen. Daneben zeigen die Ergebnisse, dass Teams ihren Rhythmus beim Bearbeiten der Aufgaben wechseln. Unklar ist allerdings noch, welche Merkmale einer Aufgabe den Rhythmus der Teamarbeit beeinflussen. Bei einem Vergleich von Aufgaben, die unterschiedliche Anforderungen beinhalten (z.B. Beurteilungsaufgaben vs. Psychomotorische Aufgaben; McGrath, 1984) bzw. mit unterschiedlichen Umweltfaktoren einhergehen (z.B. Zeitdruck), könnten diesbezüglich weitere Erkenntnisse gewonnen werden. Untersucht werden sollte in diesem Kontext auch die Interaktion zu emergenten Zuständen, denen im Rahmen der Teamforschung neben den Teamprozessen eine zentrale Rolle zugeschrieben wird (Cannon-Bowers et al., 1993; Mathieu et al., 2000).

5.3.2 Praktische Implikationen

Neben den theoretischen Implikationen können auch erste praktische Implikationen abgeleitet werden. Sowohl in Studie 1 als auch in Studie 3 konnte die Bedeutung von Teamprozessen hinsichtlich der Teamleistung erneut belegt werden. Während in Studie 1 ein positiver Zusammenhang zwischen den Teamplanungsprozessen und der Teamleistung berichtet werden konnte, zeigte sich in Studie 3 ein negativer Zusammenhang zwischen einem Rhythmus mit wechselndem Fokus (Transition vs. Aktion) und der Teamleistung bei der Bearbeitung einer kreativen Aufgabe. Zusammenfassend bedeuten diese Befunde für die Praxis, dass Teams ihr Vorgehen planen sollten, der genaue Zeitpunkt aber von entscheidender Bedeutung sein könnte.

Wichtig ist daher, dass Teams nicht unüberlegt nach dem Prinzip „je mehr desto besser“ dazu angehalten werden zu planen. Vielmehr sollte sowohl das Planungsverhalten als auch der Rhythmus der Teamarbeit durch die hier vorgestellten Erhebungsmethoden erfasst und genauer analysiert werden. Aufbauend auf zukünftiger Forschung zu Konsequenzen verschiedener Planungsprofile und verschiedener Teamrhythmen können Unternehmen dann spezifischere Teaminterventionen und Trainingsmaßnahmen ergreifen, um die Teameffektivität weiter zu steigern.

In Studie 2 konnte zudem gezeigt werden, dass Situationsmerkmale als Antezedenzien des Teamplanens fungieren. So nimmt der Umfang des Teamplanens zu, wenn wenig oder kein Zeitdruck besteht, die Aufgaben nicht routinemäßig sind oder eine hohe Folgeschwere besteht. Um dennoch von der leistungssteigernden Wirkung des Teamplanens zu profitieren, sollten Unternehmen die oben genannten Situationen vermeiden oder gezielte Interventionen zur Anregung des Planens, zum Beispiel in Form eines gezielten Coachings (Hackman & Wageman, 2005), unter den oben genannten Bedingungen einsetzen. Aufgrund eines möglicherweise überhaupt nicht vorhandenen positiven Effekts des Teamplanens auf die Teamleistung (Konradt et al., 2021) sollten potentielle Interventionen allerdings nicht unbedacht eingesetzt und deren Wirkung sorgfältig evaluiert werden, um eine Verschwendung von Ressourcen zu verhindern.

5.4 Abschließende Bemerkung

Insgesamt liefert die vorliegende Dissertation einen wichtigen Beitrag zum theoretischen und empirischen Verständnis der Funktionsweise von Teams. Aufbauend auf dem Recurring Phase Model of Team Processes von Marks et al. (2001) konnte zum einen die Bedeutung und Komplexität des Teamplanungsprozesses im Sinne eines multidimensionalen Konstruktes bestätigt und erste Befunde hinsichtlich relevanter Antezedenzien berichtet werden. Zum anderen konnte der postulierte Rhythmus der Teamarbeit erstmals empirisch untersucht und die damit einhergehenden Annahmen validiert werden. Die vorliegende Dissertation liefert damit

wichtige Ansatzpunkte und Werkzeuge für die weitere Forschung zu Teamprozessen, sowie erste Hinweise für die Praxis.

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DANKSAGUNG

An dieser Stelle möchte ich mich bei all denjenigen bedanken, die mich bei der Erstellung dieser Arbeit fachlich und moralisch unterstützt haben.

Zuerst möchte ich mich bei meinem Doktorvater Prof. Dr. Udo Konradt für die Möglichkeit bedanken, an seinem Lehrstuhl zu promovieren. Ich habe vieles in dieser intensiven Zeit gelernt und bin dankbar für die hervorragende fachliche Unterstützung. Bedanken möchte ich mich auch bei PD Dr. Daniela Renger für die Übernahme der Zweitbegutachtung.

Ein Dankeschön geht auch an Mara Santer, Alice Wang, Annika Melzer, Patrick und Kevin Hattenberg, Janne Schröder, Jana Kastner und Lena Zellmer für die Unterstützung bei der Datenerhebung. Gerade letzteren drei möchte ich einen besonderen Dank für die intensive, aber auch sehr angenehme Zusammenarbeit bei der Aufbereitung der Videodateien aussprechen.

Ganz herzlich möchte ich mich bei meinen (Ex-)Kollegen des AO-Lehrstuhls Yvonne, Kai, Stephanie, Sabrina, Alex und auch Sandra für eine schöne Zeit und viele Anregungen bedanken.

Ein besonders großes Dankeschön geht dabei an Yvonne für ihre große moralische Unterstützung.

Bedanken möchte ich mich auch bei Anna, Dorothee, Kim, Tina, den „PsychProbier & JuDo“ – Mitgliedern und meiner großartigen „Erfolgsteampartnerin und Bärenliebhaberin“ Lara. Vielen Dank!

Zuletzt möchte ich mich bei meiner Familie und Markus bedanken. Ihr seid immer für mich da und dafür bin ich euch wahnsinnig dankbar.

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