The moderating role of exercise self-schema and exercise identity on the processing of self-relevant feedback

Inauguraldissertation
zur Erlangung des Grades eines Doktors der Philosophie
im Fachbereich Psychologie und Sportwissenschaften
der Johann Wolfgang Goethe-Universität
Frankfurt am Main

vorgelegt von

Fabienne Ennigkeit
aus Darmstadt

Frankfurt am Main
2018

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Summary

Research on self and identity has a long tradition within psychology. By now, researches have reached a consensus about self and identity being largely commensurate constructs (Swann & Bosson, 2010). In this perspective, the self is seen as an *organized, active, dynamic system* of multiple self-aspects (e.g., self-schemata, Markus, 1977, or multiple identities, Burke & Stets, 2009) which is reciprocally related to the processing of self-relevant information from the psychosocial environment. One type of such information can be direct self-related feedback. Besides, most researchers agree that the *processing of self-relevant information* is influenced by different motives (Morf & Mischel, 2012), among them the self-enhancement motive (e.g., Sedikides & Gregg, 2008) and the self-consistency motive (e.g., Swann & Buhrmester, 2012).

Advocates of *self-enhancement theories* propose that individuals strive to protect or enhance their self and therefore favor to process positive feedback. In particular, they suggest that information deviating in a positive direction from one's self-assessment is favored over information that is consistent with one's self-assessment. The central assumption of *self-consistency theories* (the most prominent being self-verification theory, Swann, 1983) is that people strive to confirm their firmly held self-views in order to achieve a sense of coherence and predictability. Individuals are therefore assumed to favor feedback consistent with their self-views over positively deviating feedback. To some extent, the theories therefore make contradicting predictions.

Empirical evidence did not support the superiority of one type of theory over the other (i.e., some studies supported the assumptions of self-enhancement and others the assumptions of self-consistency theories). Therefore, researchers started to identify variables moderating whether the self-enhancement or the self-consistency motive is more dominant in a given situation (Kwang & Swann, 2010; Shrauger, 1975). On the one hand, the *type of reaction* has been found to influence information processing: If affective reaction is examined, results follow the predictions of self-enhancement theories, i.e., individuals are happier (for example) about positively deviating than about consistent feedback. Cognitive reactions, on the other hand, are dominated by self-consistency strivings, i.e. individuals feel more accurately assessed (for example) by consistent than by positively deviating feedback.

A second moderator variable concerns the *elaborateness* of the self-aspect in which feedback is provided. Elaborateness of self-aspects can be operationalized by drawing on the self-schema construct or by assessing the strength of a given identity, for instance. Highly elaborated self-aspects are aspects that occupy a central position in the self-representation, are highly self-descriptive and are strongly connected to other self-related cognitions. They are therefore assumed to be quite resistant to change (e.g., Green et al., 2005; Petersen et al., 2000a). This means that inconsistent information leads to inconsistencies and to nonverification of an already elaborated identity—a state that is to be avoided according to identity theory (e.g., Burke & Stets, 2009). In highly elaborated self-aspects, a dominance of the self-consistency principle is therefore expected. For self-aspects low in elaboration, inconsistent information doesn't lead to inconsistencies. Therefore it is assumed that individuals take the chance to self-enhance in these self-aspects and favor positively deviating as opposed to consistent feedback. These assumptions were widely confirmed by a series of studies in which personality feedback (e.g., spontaneity, masculinity, extraversion) was used (e.g., Petersen et al., 2000a, 2000b; Stahlberg et al., 1997).

Research on self and identity in sport and exercise psychology has focused largely on the effect of sport and exercise on self-esteem and the physical self-concept (Stiller & Alfermann, 2005). Although a small to moderate effect has been demonstrated, findings are not as convincing as a robust effect would suggest (e.g., Hänsel, 2008, 2012; Spence et al., 2005). The search for potential moderator variables had a strong emphasis on variables regarding sport and exercise (e.g., frequency, intensity), and less on variables regarding the person (e.g., structural aspects of the self). Concerning reactions to self-relevant feedback in the domain of sport and exercise, research has focused on either the effect of different types of technical feedback (e.g., modality, frequency) on motor learning (e.g., Schmidt & Lee, 2011) or on the effect of positive and negative feedback on intrinsic motivation (e.g., De Muynck et al., 2017). The moderating role of the elaborateness of the exercise-related self-aspect on the processing of positively deviating as opposed to consistent feedback has not yet been investigated in the field of sport and exercise.

Exercise self-schema (Kendzierski, 1988) and exercise identity (Anderson & Cychosz, 1994) constitute two constructs that can be used to operationalize the elaborateness of

the exercise-related self-aspect. Until now, these constructs have mainly been investigated regarding their association with exercise adoption and adherence. The *exercise self-schema* construct refers to cognitive generalizations about the self based on "an individual's experiences associated with exercise, such as thoughts, feelings, and motor and automatic responses to exercise" (Sabiston et al., 2012, p. 231). *Exercise identity* refers to "the salience of an individual's identification with exercise as an integral part of the concept of self" (Anderson & Cychosz, 1994, p. 747). Recent research suggests that exercise self-schema and exercise identity can be seen as generally commensurate constructs (Berry et al., 2014; Rhodes et al., 2016). On an operational level, a difference between the two is that the schema construct results in a categorization of individuals (individuals schematic for exercise vs. individuals without an exercise self-schema), whereas the identity construct measures the self-as-exerciser on a continuum.

The primary aim of the present dissertation was to examine the moderating role of the elaborateness of the exercise-related self-aspect on the processing of self-relevant information. In doing so, both affective and cognitive reactions to feedback consistent with one's own self-assessment (self-consistency) and to feedback deviating positively from one's own self-assessment (self-enhancement) were investigated. Feedback deviating negatively from one's own self-assessment was included as well, but no specific hypotheses were formulated concerning this type of feedback.

Regarding *affective reaction* (e.g., happiness about the result), no clear preference for either consistent or feedback deviating positively from one's self-assessment was predicted *for individuals with a highly elaborated self-as-exerciser* because the motives cancel each other out in this case (dominance of the self-consistency motive in highly elaborated self-aspects, but dominance of the self-enhancement motive for affective reaction). Individuals with a *self-as-exerciser low in elaborateness* were expected to favor positively deviating as opposed to consistent feedback (dominance of the self-enhancement motive both in lowly elaborated self-aspects and for affective reaction).

Regarding *cognitive reaction* (e.g., perceived accuracy of the feedback), I expected *individuals with a highly elaborated self-as-exerciser* to favor consistent as opposed to feedback deviating positively from their self-assessment (dominance of the self-consistency motive both in highly elaborated self-aspects and for cognitive reaction). For individuals with a *self-as-exerciser low in elaborateness*, I expected no clear prefer-

ence for either consistent or feedback deviating positively from their self-assessment (dominance of the self-enhancement motive in lowly elaborated self-aspects, but dominance of the self-consistency motive for cognitive reaction).

The elaborateness of the exercise-related self-aspect was operationalized either as exercise self-schema (study 2) or exercise identity (study 3). As the Exercise Identity Scale (Anderson & Cychosz, 1994)—usually used to measure exercise identity—is not yet available in German, a second aim of the present dissertation was to translate this scale into German and to test its reliability and validity (study 1). In doing so, a special focus was on investigating the factor structure of the scale, which is subject of debate for the English version (e.g., Murray et al., 2013; Reifsteck et al., 2016; Wilson & Muon, 2008): the scale is either seen as being uni- or two-dimensional (*Role Identity* and *Exercise Beliefs*). In study 1, a bifactor structure is suggested as an alternative and examined in addition.

Study 1 ($N = 530$) resulted in a successful translation of the Exercise Identity Scale into German. Regarding the factor structure, a series of confirmatory factor analyses showed that the data were best represented by a unidimensional instead of a twodimensional or bifactor model. Additionally, configural, metric and scalar invariance of the scale could be demonstrated over a time interval of 14 days ($n = 221$). Besides, the items were invariant across men and women, although this conclusion held only when considering change in CFI, not when considering the result of chi square difference testing. Finally, the convergent validity of the German translation could be demonstrated, as manifest correlations between Exercise Identity Scale scores and related constructs were in the expected direction (e.g., positive association with exercise behavior, exercise-related self-efficacy, sports competence). No association was found between exercise identity and social desirability, which argues for the discriminant validity of the scale.

Study 2 ($N = 472$) investigated the aforementioned hypotheses in an online experiment. The general design was based on previous studies (e.g., Petersen, 1994; Petersen et al., 2000a, 2000b). In a cover story, participants were told that they were to take part in a study evaluating the subjective acceptance of a newly developed test measuring six aspects of exercise. Participants were first classified as either having an exercise self-schema or not (i.e., having a self-as-exerciser high or low in elaborateness; Kendzierski, 1988). Afterwards, they rated themselves in six aspects related to exercise and sports

(e.g., physical fitness, sportiness, physical well-being). They then worked on the alleged test, consisting of questionnaire items and two reaction tests (in the style of an emotional Stroop test and an implicit association test). Subsequently, they were given bogus feedback in the six domains of the test, which was based on their earlier self-assessments only. Each participant received negatively deviating, consistent and positively deviating feedback randomly in two of the six domains. Finally, after assessing affective (spontaneous emotions, satisfaction) and cognitive (rating of the accuracy of the feedback, agreement of well-acquainted others with the feedback) reaction with two items each, the participants were fully debriefed. Data were analyzed by means of analysis of variance; affective and cognitive reactions were treated separately. Averages were computed across the two corresponding conditions resulting in one affective and one cognitive reaction score for each condition. The hypotheses could not be confirmed. For affective reaction, there was a general preference for positively deviating as opposed to consistent feedback (i.e., a dominance of the self-enhancement motive), regardless of whether the participants held an exercise self-schema or not. A significant interaction between exercise self-schema and type of feedback could be ascribed to the fact that individuals schematic for exercise reacted a lot less positively to negatively deviating in comparison to consistent feedback than individuals without exercise self-schema (e.g., they were a lot less satisfied with negatively deviating than with consistent feedback, whereas this difference was smaller for individuals without exercise self-schema). For cognitive reaction, the same pattern emerged: Regardless of whether individuals held an exercise self-schema or not, they favored positively deviating over consistent feedback. While a significant interaction between exercise self-schema and type of reaction was found here as well, this interaction could also be ascribed to the fact that individuals schematic for exercise reacted a lot less positively to negatively deviating compared to consistent feedback (e.g., they rated negatively deviating as less accurate than consistent feedback, whereas this difference was smaller for individuals without exercise self-schema). As we could not rule out the possibility that the findings contrary to expectations could be attributed to the online setting and the rather basic categorization of individuals either having an exercise self-schema or not, study 3 was designed to retest the central hypotheses by conceptually replicating study 2.

Study 3 (*N* = 215) was conducted as a laboratory experiment. Similar to study 2, participants expected to take part in a study investigating the subjective acceptance of a physical fitness test. After exercise identity was assessed with the scale described in study 1 (to assess the degree of the elaborateness of the exercise-related self-aspect), participants rated their own fitness. The alleged fitness test used the OwnIndex function implemented in some Polar heart rate watches. It estimates VO_2max from heart rate and heart rate reliability in a resting position and takes approximately five minutes. Participants could see that their heart rate was transmitted to a monitor before the start of the test. After completion of the test, their test result was presented on the same monitor. This result presented again was not based on the OwnIndex test, but on participants' earlier self-assessments. They were randomly assigned to one of three feedback conditions (negatively deviating, consistent, positively deviating). After affective (Weiner, 1985) and cognitive reactions (Swann et al., 1987; Woo & Mix, 1997) were assessed with nine items each, participants were fully debriefed. Data were analyzed by means of moderated regression analyses, with type of reaction as a multicategorical predictor and exercise identity as a continuous moderator (Hayes & Montoya, 2017). Affective and cognitive reaction were analyzed separately. The expected moderating effect of exercise identity could not be confirmed in this study either. The self-enhancement motive dominated affective reaction: Participants showed more positive emotion after positively deviating than after consistent feedback, regardless of exercise identity. For cognitive reaction, although a significant interaction between exercise identity and type of reaction emerged, further probing showed that contrary to expectations, individuals very low in exercise identity judged consistent feedback to be more accurate than positively deviating feedback. For all other individuals, we found no difference between the cognitive reaction to positively deviating and consistent feedback. Additionally, just as in study 2, individuals high in exercise identity cognitively judged negatively deviating feedback to be less accurate in comparison to consistent feedback than other individuals (for whom this difference was smaller).

Taken together, study 2 and study 2 render rather comparable results despite the fact that different designs and operationalization were used. The hypotheses could not be confirmed. *Affective reaction* seems to be driven by the self-enhancement motive, regardless of the elaborateness of the exercise-related self-aspect. This means that indi-

viduals show more positive emotion after feedback deviating positively from their self-assessment than after feedback consistent with their self-assessment.

Cognitive reaction to self-relevant feedback in the sport and exercise domain does at least partly seem to be influenced by the elaborateness of the exercise-related self-aspect, but not in the expected direction: In study 3, individuals very low in exercise identity cognitively reacted more positive to consistent as opposed to positively deviating feedback, i.e., they reacted in terms of self-consistency principles—a pattern that was originally expected for individuals high in exercise identity. This could be explained by the fact that these individuals actually do possess an elaborated exercise-related self-aspect they see as clearly self-defining, but in the opposite direction, i.e., they are schematic for *not* being an exerciser (see also the concept of nonexerciser schematics; Kendzierski, 1988). If this is the case, the finding that this result was not found in study 2 could be explained by the fact that nonexerciser schematics were not analyzed separately there, but merged with aschematics and non-classifiable participants (Kendzierski, 1988) to form a group of individuals without exercise self-schema.

In addition, in both studies a moderating effect of the elaborateness of the exercise-related self-aspect was found in that individuals with a highly elaborated self-as-exerciser reacted much more negatively to negatively deviating as opposed to consistent feedback. This seems to imply that the self-protection motive (Sedikides, 2012) is especially pronounced for high elaborateness. While this motive previously has been subsumed under the self-enhancement motive, some authors argue that protecting the self from negative (self-threatening) feedback might be a distinct motive. It could thus be worthwhile to investigate *the processing of negative feedback* in sport and exercise specifically, because it can be assumed that this coping could be of particular relevance for the relation between sport or exercise (situations in which individuals are regularly confronted with feedback) and self(-esteem).

The fact that the results of study 2 and study 3 could not replicate findings of previous studies that showed a moderating effect of elaborateness for personality traits (e.g., Petersen et al., 2000a, 2000b; Stahlberg et al., 1997) may be attributable to the domains in which feedback was given: While for many personality traits, an optimum rather than a maximum seems desirable (e.g., most people would probably agree that it is not desirable to be as spontaneous as possible), in the sport and exercise domains investigated in

study 2 and study 3, values as high as possible seem desirable in general. This could be related to the performance aspect of the self-aspects examined (Dauenheimer et al., 1997).

Further it is unclear whether the *level of initial self-assessment* might have influenced the processing of self-relevant feedback. Kwang and Swann (2010) argue that consistent feedback might as well be perceived as positive feedback, as long as initial self-assessment is high (and therefore positive anyway).

Among the noteworthy *limitations* of study 2 and study 3 are the restricted generalizability of the findings due to non-representative samples (e.g., highly educated people were overrepresented) and the operationalization of the dependent variables, for which alternatives would have been feasible (e.g., Kedharnath et al., 2009). Besides, behavioral reactions were not considered at all, although these could be particularly relevant in the sport and exercise domain. Although the fitness test used in study 3 was based on physiological data and therefore might have been perceived as more objective than the online-based test used in study 2, it is still probable that the results of a "real" fitness test involving physical exertion might be perceived as even more credible and possibly as more personally relevant to participants. Additionally, other variables moderate whether information processing is influenced more by self-enhancement or by self-consistency motives (e.g., the motivation to change one's self-views, Dauenheimer, 1996; achievement motivation, Anseel et al., 2011). Such additional variables were not considered in the present dissertation. Finally, it must be noted that the central assumption of highly elaborated self-aspects occupying a central position in the cognitive self-representation and having stronger connections to other self-relevant cognitions has been barely tested empirically (Petersen et al., 2000a). In this regard, the relation between extremity/positivity, importance and certainty of self-assessments for operationalizing elaborateness should be given further attention as well.

The present dissertation adds to the literature in social psychology and identity research on the one hand, in that it shows that the assumptions regarding the moderating role of the elaborateness of self-aspects doesn't apply for all self-aspects in a similar manner.

On the other hand, it adds to the literature in sport and exercise psychology: the moderating role of the elaborateness of the exercise-related self-aspect has not yet been examined in the field of sport and exercise. Exercise self-schema and exercise identity as

structural aspects of the self could be further investigated in future studies dealing with the processing of exercise-related feedback. The question of how exercise self-schema and exercise identity develop over time might be especially interesting in this context (Rhodes et al., 2016; Strachan & Whaley, 2013). With the translation of the Exercise Identity Scale into German (study 1) the interplay between social cognitive and affective variables in increasing exercise adherence can now be investigated in German-speaking samples, while also including other relevant theories (e.g., self-determination theory, Ryan & Deci, 2012).

German Summary – Deutsche Zusammenfassung

Die Forschung zum Selbst und zur Identität hat in der Psychologie eine lange Tradition. Mittlerweile besteht weitgehender Konsens darüber, dass Selbst und Identität – trotz unterschiedlicher Forschungstraditionen – als weitgehend deckungsgleiche Konstrukte (Swann & Bosson, 2010) verstanden werden können. Das Selbst bzw. die Identität wird in diesem Verständnis als ein *organisiertes, aktives, dynamisches System* verschiedener Selbstaspekte (z. B. konzeptualisiert als Selbstschemata, Markus, 1977, oder Teilidentitäten, Burke & Stets, 2009) verstanden, das in wechselseitiger Beziehung mit der Verarbeitung von selbstbezogenen Informationen aus der psychosozialen Umwelt steht. Solche selbstbezogenen Informationen können z. B. direkte Rückmeldungen zur eigenen Person sein. Zusätzlich wird postuliert, dass die *selbstbezogene Informationsverarbeitung* von bestimmten Motiven beeinflusst wird (Morf & Mischel, 2012). Zu diesen Motiven gehören das Streben nach Selbstwerterhöhung (z. B. Sedikides & Gregg, 2008) sowie das Streben nach Konsistenz (z. B. Swann & Buhrmester, 2012).

Die zentrale Annahme von *Selbstwerterhöhungstheorien* ist, dass Individuen motiviert sind, ihr Selbst zu schützen bzw. zu erhöhen und daher bevorzugt positive selbstbezogene Informationen verarbeiten. Insbesondere wird angenommen, dass solche Informationen, die in eine positive Richtung von der eigenen Selbsteinschätzung abweichen, gegenüber mit der eigenen Selbsteinschätzung übereinstimmenden (konsistenten) Informationen bevorzugt verarbeitet werden. Vertreter von *Selbstkonsistenztheorien* (die prominenteste Theorie ist die Selbstverifikationstheorie von Swann, 1983) nehmen dagegen an, dass Menschen nach der Bestätigung ihres Selbstbilds streben, da dies ein Gefühl von Kohärenz und Vorhersagbarkeit vermitteln würde. Sie verarbeiten daher bevorzugt konsistente (d. h. mit ihrer Selbsteinschätzung übereinstimmende) im Gegensatz zu von der Selbsteinschätzung positiv abweichenden Informationen. Die beiden Theorien machen daher zumindest teilweise gegensätzliche Vorhersagen.

Da empirische Befunde keine eindeutigen Hinweise für die Überlegenheit einer der beiden Theoriestränge liefern (es finden sich sowohl Studien, die die Annahmen der Selbstwerterhöhungs-, als auch solche, die die Annahmen der Selbstkonsistenztheorien stützen), wurden zentrale Variablen identifiziert, die moderieren, ob in einer bestimmten Situation eher das Motiv nach Selbstwerterhöhung oder das Motiv nach Selbstkonsistenz dominiert (Kwang & Swann, 2010; Shrauger, 1975). Einerseits betrifft dies die *Art*

der Reaktion: Wenn affektive Reaktionen untersucht werden, reagieren Menschen in der Regel im Sinne der Selbstwerterhöhungstheorie, d. h. sie freuen sich z. B. stärker über eine positiv abweichende als über eine konsistente Rückmeldung. Bei kognitiven Reaktionen dominiert dagegen das Motiv der Selbstkonsistenz, d. h. Individuen berichten z. B., dass konsistente Rückmeldungen im Vergleich zu positiv abweichenden besser zutreffen.

Eine zweite Moderatorvariable betrifft die *Elaboriertheit* des Selbstaspekts, in dem die Rückmeldung erfolgt. Die Operationalisierung der Elaboriertheit kann z. B. durch das Selbstschemakonzept oder die Erfassung der Stärke einer spezifischen Identität erfolgen. Unter hoch elaborierten Selbstaspekten (d. h. schematischen Selbstaspekten oder Selbstaspekten, mit denen Individuen sich stark identifizieren) werden solche Selbstaspekte verstanden, die eine zentrale Stellung im Selbstsystem einnehmen, dadurch auch als stark selbstbeschreibend eingeschätzt werden und sich durch eine hohe Vernetzung mit anderen selbstbezogenen Kognitionen auszeichnen. Sie sind daher durch einen hohen Änderungswiderstand gekennzeichnet (z. B. Green et al., 2005, Petersen et al., 2000a), sodass die Integration inkonsistenter Informationen zu Widersprüchen bzw. zu einer Nichtbestätigung einer bereits bestehenden Identität führen würde – ein Zustand, der möglichst vermieden werden will (z. B. Burke & Stets, 2009). Für hoch elaborierte Selbstaspekte wird demnach eine Dominanz des Selbstkonsistenzmotivs erwartet. Für niedrig elaborierte Selbstaspekte dagegen erzeugen inkonsistente Informationen keine Widersprüche, weshalb davon ausgegangen wird, dass Personen die Chance auf Selbstwerterhöhung nutzen und bevorzugt positiv abweichende im Vergleich zu konsistenten Informationen verarbeiten. Die Vorhersagen wurden in einer Reihe von Studien weitgehend bestätigt, wobei sich die Rückmeldungen in der Regel auf Persönlichkeitseigenschaften wie Spontaneität, Maskulinität oder Extraversion bezogen (z. B. Petersen et al., 2000a, 2000b; Stahlberg et al., 1997).

In der *sportpsychologischen Selbstkonzeptforschung* lag ein Schwerpunkt v. a. auf der Untersuchung des Einflusses sportlicher Aktivität auf das Selbst, insbesondere auf das globale Selbstwertgefühl und den physischen Selbstaspekt (Stiller & Alfermann, 2005). Obwohl prinzipiell ein kleiner bis moderater Einfluss nachgewiesen werden kann, ist die Befundlage nicht so homogen, wie man es bei einem robusten Effekt erwarten kann (z. B. Hänsel, 2008, 2012; Spence et al., 2005). Die Suche nach moderierenden Variab-

len beschränkte sich in der Vergangenheit vor allem auf Charakteristika der sportlichen Aktivität (z. B. Häufigkeit, Intensität) und weniger auf Charakteristika der Person (z. B. strukturelle Aspekte des Selbst). In Bezug auf die Verarbeitung selbstbezogener Rückmeldungen im Sport standen bislang Studien im Vordergrund, in denen entweder verschiedene Formen technischen Feedbacks (z. B. Modalität, Häufigkeit) auf das motorische Lernen (z. B. Schmidt & Lee, 2011) oder die Wirkung positiver oder negativer Rückmeldungen auf die intrinsische Motivation untersucht wurde (z. B. De Muynck et al., 2017). Die moderierende Rolle der Elaboriertheit des sportbezogenen Selbstaspekts auf die Verarbeitung positiv abweichender im Gegensatz zu konsistenten Rückmeldungen wurde dagegen im Bereich des Sports bislang nicht untersucht.

Mit dem Selbstschema im Bereich sportlicher Aktivität (Exercise Self-Schema; Kendzierski, 1988) und der Sportleridentität (Exercise Identity; Anderson & Cychosz, 1994) stehen im Bereich der Sportpsychologie zwei Konstrukte zur Verfügung, mit denen die Elaboriertheit des sportbezogenen Selbstaspekts erfasst werden kann. Die Konstrukte wurden bisher v. a. im Hinblick auf ihren Zusammenhang mit der Bindung an sportliche Aktivität untersucht. Unter dem *Exercise Self-Schema* werden kognitive selbstbezogene Generalisierungen verstanden, die auf den sportlichen Erfahrungen eines Individuums basieren und Gedanken, Gefühle und automatische Reaktionen auf sportliche Aktivität umfassen (Sabiston et al., 2012). Die *Exercise Identity* bezeichnet die Salienz der Identifikation eines Individuums mit sportlicher Aktivität als wesentlichen Teil des Selbstkonzepts (Anderson & Cychosz, 1994). Neuere Studien zeigen, dass Exercise Self-Schema und Exercise Identity im Wesentlichen als sich entsprechende Konstrukte angesehen werden können (Berry et al., 2014; Rhodes et al., 2016). Auf operationaler Ebene besteht ein Unterschied darin, dass das Schemakonstrukt eine Kategorisierung vornimmt (Schematiker vs. Personen ohne Schema), während das Identitätskonstrukt die Relevanz des sportbezogenen Selbstaspekts für das Individuum auf einem Kontinuum erfasst.

Das Hauptziel der vorliegenden kumulativen Dissertation war es, die moderierende Rolle der Elaboriertheit des sportbezogenen Selbstaspekts bei der Verarbeitung selbstbezogener Informationen zu untersuchen. Dabei wurden sowohl affektive als auch kognitive Reaktionen auf mit der eigenen Selbsteinschätzung übereinstimmende (Selbstkonsistenz) sowie von der eigenen Selbsteinschätzung positiv abweichende Rückmeldungen

(Selbstwerterhöhung) untersucht. Zusätzlich wurden auch von der eigenen Selbstein-schätzung negativ abweichende Rückmeldungen integriert, wobei für diese keine Hypo-thesen formuliert wurden.

Erwartet wurde, dass sich in Bezug auf die *affektive Reaktion* (z. B. Freude über die Rückmeldung) bei *Personen mit hoch elaboriertem sportbezogenen Selbstaspekt* keine eindeutige Präferenz für konsistente im Vergleich zu positiven Rückmeldungen vorher-gesagt, da sich die beiden Motive gegenseitig aufheben (Dominanz des Selbstkonsis-tenzmotivs in hoch elaborierten Selbstaspekten, aber Dominanz des Selbstwerterhö-hungsmotivs für affektive Reaktionen). Für *Personen mit gering elaboriertem sportbe-zogenen Selbstaspekt* wurde dagegen vermutet, dass positive Rückmeldungen gegen-über konsistenten bevorzugt werden sollen (Dominanz des Selbstwerterhöhungsmotivs in gering elaborierten Selbstaspekten sowie für affektive Reaktionen).

Für die *kognitive Reaktion* wurde erwartet, dass *Personen mit hoch elaboriertem sport-bezogenen Selbstaspekt* (z. B. wahrgenommene Genauigkeit des Ergebnisses) konsis-tente Rückmeldungen gegenüber positiven bevorzugen (Dominanz des Selbstkonsis-tenzmotivs in hoch elaborierten Selbstaspekten sowie für kognitive Reaktionen). Für *Personen mit gering elaboriertem sportbezogenen Selbstaspekt* wurde dagegen keine eindeutige Präferenz für konsistente vs. positive Rückmeldungen erwartet (Dominanz des Selbstwerterhöhungsmotivs in gering elaborierten Selbstaspekten, aber Dominanz des Selbstkonsistenzmotivs für kognitive Reaktionen).

Als Maß für die Elaboriertheit wurde dabei einerseits auf das Exercise Self-Schema (Studie 2) sowie andererseits auf die Exercise Identity (Studie 3) zurückgegriffen. Da die üblicherweise zur Erfassung der Exercise Identity verwendete Exercise Identity Sca-le (Anderson & Cychosz, 1994) bislang nicht auf Deutsch vorliegt, bestand ein zweites Ziel der vorliegenden Dissertation darin, diese Skala ins Deutsche zu übersetzen und die Reliabilität und Validität der übersetzten Version zu prüfen (Studie 1). Ein besonderes Augenmerk lag dabei auf der Faktorstruktur der Skala, für die in der englischsprachigen Literatur heterogene Befunde vorliegen: Die Skala wird dabei entweder als ein- oder zweidimensional (Faktoren *Role Identity* und *Exercise Beliefs*) angesehen (z. B. Murray et al., 2013; Reifsteck et al., 2016; Wilson & Muon, 2008). In Studie 1 wird zusätzlich eine bifaktorielle Struktur vorgeschlagen und geprüft.

Studie 1 (*N* = 530) resultierte in einer erfolgreichen Übersetzung der Exercise Identity Scale ins Deutsche. Bezüglich der Faktorstruktur zeigte sich in einer Reihe von konfirmatorischen Faktorenanalysen, dass das eindimensionale Modell die Daten im Vergleich mit einem zweidimensionalen und einem Bifaktormodell am besten abbildet. Zusätzlich konnte konfigurale, metrische und skalare Invarianz der Skala über einen Zeitraum von 14 Tagen (*n* = 221) demonstriert werden. Die Skala erwies sich außerdem als invariant zwischen Männern und Frauen, allerdings nur bei Zugrundelegung der Veränderung des CFI, nicht bei Zugrundelegung der Chi-Quadrat-Differenztests. Schließlich konnte die konvergente Validität der deutschen Übersetzung durch erwartete Zusammenhänge der Ausprägung der Exercise Identity mit verwandten Konstrukten auf manifester Ebene bestätigt werden (z. B. positive Zusammenhänge mit Sportverhalten, sportbezogene Selbstwirksamkeit, Sportkompetenz). Keine Zusammenhänge bestanden mit sozialer Erwünschtheit, was für die diskriminante Validität der Skala spricht.

Studie 2 (*N* = 472) untersuchte die o. g. Hypothesen mithilfe eines Onlineexperiments. Der generelle Versuchsaufbau orientierte sich dabei an vorherigen Studien (z. B. Petersen, 1994; Petersen et al., 2000a, 2000b). Die Coverstory bestand darin, dass die subjektive Akzeptanz eines neu entwickelten Tests zu Aspekten der Sportlichkeit und Gesundheit ermittelt werden sollte. Die Teilnehmer/-innen wurden zunächst mittels der Skala von Kendzierski (1988) in Personen mit und ohne Exercise Self-Schema (d. h. mit hoch und niedrig elaboriertem sportbezogenen Selbstaspekt) kategorisiert. Im Anschluss schätzen sie sich selbst in sechs sportbezogenen Bereichen (z. B. physische Fitness, Sportlichkeit, körperliches Wohlbefinden) ein. Danach bearbeiteten sie den angeblichen Test, der aus Fragebogenitems sowie zwei Reaktionstests (emotionaler Stroop-Test sowie Impliziter Assoziationstest) bestand. Sie bekamen in der Folge Rückmeldungen in den sechs sportbezogenen Bereichen präsentiert, wobei diese Rückmeldungen ausschließlich auf ihren vorherigen Selbsteinschätzungen und nicht auf dem angeblichen Test beruhten. Die Teilnehmer/-innen bekamen randomisiert je zwei negativ abweichende, zwei konsistente sowie zwei positive Rückmeldungen. Anschließend wurden die affektive (spontanes Gefühl, Zufriedenheit) sowie die kognitive Reaktion (Beurteilung der Genauigkeit des Feedbacks und der Übereinstimmung des Feedbacks mit der Einschätzung guter Bekannter) durch je zwei Items erfasst, bevor ein ausführliches Debriefing erfolgte. Die Datenanalyse erfolgte varianzanalytisch getrennt für die affektive

und die kognitive Reaktion, wobei die Reaktionen auf die Rückmeldungen derselben Bedingung (negativ, konsistent, positiv) gemittelt wurden. Die aufgestellten Hypothesen konnten nicht bestätigt werden. Für die affektive Reaktion zeigte sich eine generelle Präferenz positiv abweichender gegenüber konsistenter Rückmeldungen (d. h. eine Dominanz des Selbstwerterhöhungsmotivs), unabhängig davon, ob die Teilnehmer/-innen als schematisch im Bereich sportlichen Trainings kategorisiert worden waren oder nicht. Eine signifikante Interaktion zwischen Selbstschema und Art der Rückmeldung ließ sich darauf zurückführen, dass Personen mit Exercise Self-Schema auf negativ abweichenden Rückmeldungen im Vergleich mit konsistenten deutlich weniger positiv reagierten als Personen ohne Exercise Self-Schema (also z. B. deutlich weniger zufrieden mit negativ abweichenden Rückmeldungen im Vergleich zu konsistenten waren, während dieser Unterschied bei Personen ohne Exercise Self-Schema geringer war). Für die kognitive Reaktion zeigte sich dasselbe Muster: Unabhängig vom Vorliegen eines Selbstschemas im Bereich sportlichen Trainings bevorzugten die Teilnehmer/-innen positiv abweichende gegenüber konsistenten Rückmeldungen. Auch hier ergab sich zwar eine signifikante Interaktion zwischen Selbstschema und Art der Rückmeldung, die jedoch ebenfalls darauf basierte, dass schematische Teilnehmer/-innen weniger positiv auf negativ abweichende im Vergleich zu konsistenten Rückmeldungen reagierten als Personen ohne Exercise Self-Schema (also z. B. negativ abweichende Rückmeldungen als deutlich weniger zutreffend bewerteten als konsistente, während dieser Unterschied bei Personen ohne Exercise Self-Schema geringer war). Da nicht ausgeschlossen werden konnte, dass die erwartungswidrigen Befunde u. a. auf das Onlinesetting sowie die recht grobe Kategorisierung in Personen mit und ohne Exercise Self-Schema zurückgeführt werden konnte, wurde in Studie 3 eine konzeptuelle Replikation des Experiments angestrebt.

Studie 3 ($N = 215$) erfolgte als Laborexperiment. Ähnlich wie bei Studie 2 bestand die Coverstory darin, die subjektive Akzeptanz eines Fitnesstests überprüfen zu wollen. Zunächst wurde die Ausprägung der Exercise Identity (d. h. die Elaboriertheit des sportbezogenen Selbstaspekts) mittels des in Studie 1 übersetzten Fragebogens erfasst. Nachdem die Teilnehmer/-innen ihre eigene körperliche Fitness eingeschätzt hatten, wurde der angebliche Fitnesstest durchgeführt. Dieser bestand in der Erfassung der VO_2max durch die OwnIndex-Funktion, die in einigen Uhren der Firma Polar integriert

ist. Dieser Test beruht auf der Messung der Ruheherzfrequenz und Herzfrequenzvariabilität im Liegen und dauert ca. fünf Minuten. Die Teilnehmer/-innen konnten vor Beginn des Tests sehen, dass ihre Herzfrequenz auf einen angeschlossenen Monitor übertragen wurde, auf dem nach Abschluss des Tests auch das Ergebnis rückgemeldet wurde. Dieses rückgemeldete Ergebnis beruhte wiederum nicht auf dem OwnIndex-Test, sondern ausschließlich auf der vorherigen Selbsteinschätzung der Teilnehmer/-innen. Randomisiert wurde diesen entweder eine negativ abweichende, konsistente oder positiv abweichende Rückmeldung gegeben. Im Anschluss wurden affektive (Weiner, 1985) und kognitive Reaktionen (Swann et al, 1987; Woo & Mix, 1997) auf das Ergebnis mit jeweils neun Items erfasst und es erfolgte ein Debriefing der Teilnehmer/-innen. Die Datenanalyse erfolgte getrennt für affektive und kognitive Reaktionen mithilfe moderierter Regressionsanalysen, mit der Art der Rückmeldung als multikategorialem Prädiktor und der Exercise Identity als kontinuierlichem Moderator (Hayes & Montoya, 2017). Auch in dieser Studie zeigte sich der erwartete moderierende Effekt der Exercise Identity nicht. Die affektive Reaktion wurde vom Motiv der Selbstwerterhöhung dominiert: Die Teilnehmer/-innen berichteten positivere Emotionen nach positiv abweichenden als nach konsistenten Rückmeldungen, unabhängig von der Ausprägung der Exercise Identity. Für die kognitive Reaktion zeigte sich zwar eine signifikante Interaktion von Exercise Identity und Art der Rückmeldung, allerdings deutete diese darauf hin, dass Personen mit sehr geringer Exercise Identity konsistente Rückmeldungen kognitiv positiver bewerteten als positiv abweichende (also z. B. konsistente Rückmeldungen als zutreffender beurteilten als positiv abweichende). Für alle anderen Personen ergaben sich keine Unterschiede in der Reaktion auf konsistente und positive Rückmeldungen. Zusätzlich ergab auch diese Studie, dass Personen mit hoher Exercise Identity im Gegensatz zu den übrigen Teilnehmer/-innen kognitiv weniger positiv auf negativ abweichendes im Vergleich zu konsistentem Feedback reagierten (d. h., dass sie konsistentes Feedback als deutlich zutreffender beurteilen als negatives, während bei Personen mit geringer Exercise Identity dieser Unterschied geringer war).

Zusammengenommen ergeben die Studien 2 und 3 trotz teilweise unterschiedlicher Designs und Operationalisierungen recht ähnliche Ergebnisse in Bezug auf die Hypothesen, die sich nicht bestätigen ließen: Die *affektive Reaktion* scheint unabhängig von der Elaboriertheit des sportbezogenen Selbstaspekts den Vorhersagen der Selbstwerterhö-

hungstheorie zu folgen, d. h. Personen zeigen positivere Emotionen nach von ihrer Selbsteinschätzung positiv abweichenden als nach mit ihrer Selbsteinschätzung übereinstimmenden Rückmeldungen.

Die *kognitive Reaktion* auf selbstbezogene Rückmeldungen im Bereich des Sports scheint etwas stärker durch die Elaboriertheit des sportbezogenen Selbstaspekts beeinflusst zu werden, allerdings nicht in der vorhergesagten Weise: In Studie 3 reagierten erwartungswidrig Personen mit einer sehr gering ausgeprägten Elaboriertheit des sportbezogenen Selbstaspekts im Sinne der Selbstkonsistenztheorie, d. h. sie reagierten kognitiv positiver auf konsistente als auf positiv abweichende Rückmeldungen – ein Effekt, der ursprünglich für Personen mit hoher Exercise Identity erwartet wurde. Dies könnte darauf hindeuten, dass diese Personen einen stark elaborierten sportbezogenen Selbstaspekt in die entgegengesetzte Richtung aufweisen, d. h., sie haben ein sehr klares Bild davon, dass sie sich selbst *nicht* als Sportler sehen (ähnlich des Konzepts der Nichtschematiker; Kendzierski, 1988). Dass sich dieser Befund in Studie 2 nicht zeigte, könnte daher damit zusammenhängen, dass in dieser Studie alle Personen ohne Exercise Self-Schema (d. h. Aschematiker, Nichtschematiker, nicht Klassifizierte in der ursprünglichen Kategorisierung von Kendzierski, 1988) zusammengefasst und Nichtschematiker nicht separat betrachtet wurden.

In beiden Studien zeigte sich darüber hinaus ein moderierender Effekt der Elaboriertheit des sportbezogenen Selbstaspekts dahingehend, dass Personen mit hoch elaboriertem Selbstaspekt kognitiv deutlich negativer auf negativ abweichende im Vergleich mit konsistenten Rückmeldungen reagierten. Dies spricht dafür, dass bei hoher Elaboriertheit das Motiv des Selbstschutzes (Sedikides, 2012) besonders stark ausgeprägt zu sein scheint. Während dieses Motiv in der Vergangenheit als Teil der Selbstwerterhöhung diskutiert wurde, plädieren einige Autoren dafür, den Schutz des Selbst vor negativem (selbstbedrohendem) Feedback als eigenes Motiv anzusehen. Es könnte sich also lohnen, in zukünftigen Untersuchungen die *Verarbeitung negativer Rückmeldungen* im Sport gezielt zu untersuchen, da davon auszugehen ist, dass diese den Zusammenhang von sportlicher Aktivität (in der Personen regelmäßig mit selbstbezogenem Feedback konfrontiert werden) und Selbst(wert) besonders beeinflussen könnte.

Dass die Ergebnisse früherer Studien, die einen moderierenden Effekt der Elaboriertheit von Selbstaspekten auf die Informationsverarbeitung in verschiedenen Persönlichkeits-

eigenschaften gefunden hatten (z. B. Petersen et al., 2000a, 2000b; Stahlberg et al., 1997), sich im Bereich des Sports nicht replizieren ließen, könnte mit den inhaltlichen Bereichen zusammenhängen, in denen die Rückmeldung erfolgte: Während bei Persönlichkeitseigenschaften eher ein *Optimum als ein Maximum* erstrebenswert erscheint (z. B. würden die meisten Menschen zustimmen, dass es kein erstrebenswertes Ziel ist, möglichst maximal spontan zu sein), scheinen in den in Studie 2 und Studie 3 untersuchten Aspekten möglichst hohe Werte den meisten Menschen wünschenswert. Dies kann mit dem Leistungsbezug der untersuchten Selbstaspekte zusammenhängen (Dauenheimer et al., 1997).

Unklar ist auch, inwiefern die *Höhe der ursprünglichen Selbsteinschätzung* die Ergebnisse beeinflusst haben könnte. Kwang und Swann (2010) argumentieren, dass konsistente Ergebnisse zugleich als positive Ergebnisse wahrgenommen werden könnten, wenn die Selbsteinschätzung hoch (also sowieso positiv) ist.

Als *Limitationen* der Studien 2 und 3 müssen u. a. die eingeschränkte Generalisierbarkeit der Ergebnisse aufgrund der nicht repräsentativen Stichproben (z. B. eher Personen mit höherem Bildungsgrad) sowie die Operationalisierung der abhängigen Variablen genannt werden, für die auch Alternativen denkbar gewesen wären (z. B. Kedharnath et al., 2009). Zudem wurden Reaktionen auf der Verhaltensebene nicht betrachtet, obwohl diese im Bereich des Sports eine zentrale Rolle spielen dürften. Zwar kann der zur Generierung des fiktiven Feedbacks eingesetzte, auf physiologischen Daten basierende und damit objektiver erscheinende Test in Studie 3 als Verbesserung gegenüber dem rein onlinebasierten Test in Studie 2 angesehen werden. Dennoch ist davon auszugehen, dass Feedback, welches auf einem Fitnesstest unter körperlicher Anstrengung basiert, von den Teilnehmer/-innen als noch glaubwürdiger und möglicherweise auch persönlich relevanter erlebt werden würde. Außerdem sind weitere Variablen bekannt, die moderieren, ob eher Selbstwert- oder eher Selbstkonsistenzmotive wirken (z. B. die Motivation zur Veränderung des entsprechenden Selbstaspekts, Dauenheimer, 1996; Leistungsmotivation, Anseel et al., 2011), die in der vorliegenden Dissertation nicht berücksichtigt wurden. Schließlich muss angemerkt werden, dass die zentrale Annahme, dass hoch elaborierte Selbstaspekte eine zentrale Stellung in der kognitiven Selbstrepräsentation einnehmen und stärker mit anderen selbstbezogenen Kognitionen verknüpft sind, bisher nur sehr rudimentär geprüft wurde (Petersen et al., 2000a). In diesem Zusammenhang

sollte auch das Verhältnis von Extremität/Positivität, Wichtigkeit und Sicherheit der Selbsteinschätzung für die Operationalisierung der Elaboriertheit noch einmal beleuchtet werden.

Die vorliegende Dissertation erhellt einerseits den Forschungsstand innerhalb der Sozialpsychologie sowie der Identitätsforschung dahingehend, dass die Annahmen bezüglich der moderierenden Wirkung der Elaboriertheit von Selbstaspekten nicht für alle Selbstaspekte gleichermaßen gelten.

Andererseits trägt sie zum Forschungsstand innerhalb der Sportpsychologie bei: Die Rolle der Elaboriertheit des sportbezogenen Selbstaspekts bei der Verarbeitung selbstbezogener Informationen wurde im Bereich des Sports bislang noch nicht untersucht. Als strukturelle Aspekte des Selbst können Exercise Self-Schema und Exercise Identity in Zukunft stärker im Hinblick darauf hin analysiert werden, inwieweit diese die Verarbeitung selbstbezogener Rückmeldungen im Bereich des Sports beeinflussen. Hierbei dürfte insbesondere die Untersuchung der Frage interessant sein, wie sich Exercise Self-Schema und Exercise Identity überhaupt ausbilden und über den Lebenslauf entwickeln (Rhodes et al., 2016; Strachan & Whaley, 2013). Mit der Übersetzung der Exercise Identity Scale ins Deutsche (Studie 1) kann auch an deutschsprachigen Stichproben untersucht werden, wie verschiedene sozial-affektive und -kognitive Variablen zusammenwirken, um die Bindung an sportliche Aktivität zu stärken, auch unter Einbezug verwandter Theoriestränge (z. B. Selbstdeterminationstheorie; Ryan & Deci, 2012).

1   Introduction

Imagine physical exercise has always been an important part of your life. You remember a lot of experiences related to your exercise, you have a number of friends you know from exercise activities and if someone asks you to describe yourself to him, you will always mention that you see yourself as an exerciser. Thus, you identify strongly with being an exerciser and you have quite clear representations of what your strengths and weaknesses are in terms of exercising. Now image going to a new fitness center. They offer to measure your strength by means of a maximal strength test. Afterwards, you are told that you have an excellent strength level—a result that does not really mirror your own self-assessment, because you know that although you are regularly physically active, maximal strength has never been your strongest point. So how do you react to this feedback? Are you happy about it? Probably. Do you think it is an accurate assessment of your strength abilities? Probably not. This example shows that your self-assessments—or self-views—influence how you react to feedback. The nature of your reaction depends not only on whether affective (e.g., happiness) or cognitive (e.g., accuracy judgement) reactions are considered, but also on whether the feedback is consistent or inconsistent with your own self-view.

In many sport and exercise situations[1], individuals are regularly confronted with self-relevant feedback: The physical education teacher finds fault with a student's willingness to make an effort, a coach compliments a child for its talent regarding heading abilities in a football club, an instructor provides an elderly woman with the result of a flexibility test in a preventive back pain training, a triathlete tries to equal her times run in training in competition—there are countless more examples. In sport and exercise psychology, how individuals react to feedback has mainly been investigated with a focus on consequences for motivation and subsequent performance. For example, a number of studies have shown that positive feedback enhances intrinsic motivation, perceived competence, and motor learning (e.g., Àvila, Chiviacowsky, Wulf & Lewthwaite, 2012; De Muynck et al., 2017; Mouratidis, Vansteenkiste, Lens, & Sideridis, 2008; Whitehead & Corbin, 1991).

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[1] It should be noted that the studies presented in this doctoral dissertation were conducted in German language. Unlike in English, there is no linguistic distinction between exercise and sport in German. Therefore, in what follows, exercise and sport situations will be considered together.

But surely this does not mean that teachers, coaches and instructors should always provide positive feedback. How is such feedback processed by individuals? Do affective and cognitive reactions differ? And is the processing of the feedback dependent on self-views and a perceived consistency or inconsistency between feedback and self-assessment of the person? The image individuals have of themselves is based largely on the processing of self-relevant feedback. But how is the processing of such information regulated? Which factors influence whether feedback is rejected or accepted? Which motives underlie the processing of self-relevant feedback? Questions like these have barely been addressed in the sport and exercise domain.

The present cumulative doctoral dissertation aims to investigate the moderating role of exercise self-schema and exercise identity in the processing of self-relevant feedback. I[2] will first discuss some fundamentals concerning self and identity in chapter 1.1, in particular a short historical outline (chapter 1.1.1), the meanings of self and identity (1.1.2) and conceptions about content and structure of the self (chapter 1.1.3). Afterwards, I will turn to the reciprocal relationship between self and information processing (chapter 1.2). Sources of self-representation are presented in chapter 1.2.1, and the processing of information in form of direct feedback is discussed afterwards in more detail (chapter 1.2.2). Central to the present dissertation is the introduction of the self-enhancement (chapter 1.2.3.1) and the self-consistency principle (chapter 1.2.3.2) as essential self-evaluation motives that guide information processing; in that the self-enhancement principle predicts a preference for positive, whereas the self-consistency principle predicts a preference for consistent information. As both principles have received ample empirical evidence, variables that moderate whether the self-enhancement or the self-consistency principle is more dominant are then presented in chapter 1.2.4. These include the type of reaction (affective vs. cognitive, chapter 1.2.4.1) and the elaborateness of the self-aspect in question (chapter 1.2.4.2). It is assumed that cognitive reaction and information processing in highly elaborated self-aspects follow the predictions of self-consistency theories, whereas affective reaction and information processing in less elaborated self-aspects follow the predictions of self-enhancement theories. In the field of sport and exercise psychology, exercise self-schema and exercise identity represent

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[2] In chapters 1 (Introduction) and 3 (General Discussion), I have strictly used the first person singular, even when referring to co-authored ideas presented within the three articles in chapter 2 (Empirical Studies/Appendices A to C).

constructs that can be used to operationalize the elaborateness of the self-as-exerciser. These constructs, their measurement, and previous empirical findings related to these constructs will be discussed in chapters 1.3.1 and 1.3.2, before I provide arguments that both constructs can be considered as generally commensurate (chapter 1.3.3). From this theoretical background and the empirical evidence, I will then derive the research questions and hypotheses of the present dissertation in chapter 1.4, and will explain how each of the three empirical studies discussed in chapter 2 will address these questions.

Chapter 2 then summarizes the three studies that comprise the present dissertation: Study 1 deals with the German translation and validation of the Exercise Identity Scale (EIS; Anderson & Cychosz, 1994). A special focus is on the factor structure of the scale, which is subject of debate for the English version (chapter 2.2). The second and third study, respectively, examine the moderating role of exercise-self schema (chapter 2.3) and exercise identity (chapter 2.4) on the processing of consistent and positive self-revelant feedback in the sport and exercise domain.

Finally, chapter 3 provides a general discussion of the results of study 2 and study 3 (chapter 3.1), including limitations (chapter 3.2) as well as conclusions and future research directions (chapter 3.3).

1.1   Self and identity

In the following section, I will give a brief historical overview of self and identity research in psychology and related scientific fields (chapter 1.1.1). Afterwards, I attempt to explain what is meant by the terms *self*, *self-concept* and *identity* (chapter 1.1.2). The focus of this chapter then is on content and structure of the self. Three different structural models of self-related representations will be presented (chapter 1.1.3).

The present chapter has a strong focus on psychological and sociological research outside of the sport and exercise domain. However, where appropriate, cross references to sport and exercise science will be made. Self-representations concerning the self as an exerciser will be presented in more depth in chapter 1.3.

1.1.1   A brief historical outline

In what follows, the history of research on self and identity will be outlined (very) briefly, based on the reviews by Leary and Tangney (2012) as well as Morf and Mischel

(2012)[3]. Although questions regarding self and identity have been of interest to humans even in the centuries before Christ (e.g., in the philosophy of Gautama Buddha, circa 563-483 BC, or in the work of Plato, circa 428-347 BC) and to philosophers like Descartes in the 17th century, the beginning of the academic discussion of the self in psychology is often traced back to William James (1890). James (1890) was the first to acknowledge that the self can at the same time be the subject ("*I*"—the "self as knower" or the self as a process) as well as the object ("*Me*"—the "self as known" or the self as a product) of interest. He believed only the *Me* was accessible to empirical investigation and differentiated between a material (e.g., body, family, money), a social (who we are in a given social situation) and a spiritual self (i.e., who we are at our core, e.g., personality, core values, introspection). In the following years, research on self and identity has further been advanced especially by sociologists, first of all predecessors of symbolic interactionism, like Charles Cooley (1902) and George Herbert Mead (1934). Cooley's (1902) theory of the "looking glass self" assumes that individuals create their self-perceptions through social interaction.

From the 1930s to the 1960s, behaviorism was the prevalent school of thought in psychology and therefore, the self was deemed not to be accessible to empirical research. Aside from a few exceptions (e.g., Allport, 1955; Rogers, 1959), self and identity received relatively little empirical attention. An exception was research on self-esteem that was treated mainly from a trait perspective. The development of questionnaires assessing self-esteem (e.g., Rosenberg, 1965) contributed to an increased engagement in this field.

The cognitive revolution in the 1960s and 1970s was concerned with the self mainly as a cognitive, unmotivated knowledge structure. Under the umbrella of social cognition, the 1970s can be seen as a heyday of self-concept research with the introduction of constructs like self-concept, self-perception, self-awareness, self-schema, self-presentation, and self-monitoring, and accompanying measures of these constructs which were mainly seen as dispositional attributes. The primary topic of investigation was the "self as known", i.e., the contents and structure of the self. This cognitive orientated approach toward self-concept research in psychology also led to an increased interest in identity research in sociology and social psychology, respectively.

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[3] For more detailed, but not very recent historical reviews see also Baumeister (1987) and Harter (1996).

In the 1980s and 1990s, researchers started to be interested in processing and agentic qualities of the self. The self was acknowledged as being motivated and as being guided by goals, expectations, beliefs, and values. The biggest challenge was to model the self without having to rely on the idea of a "homunculus". Concepts like cybernetic feed-back control loops or self-regulation theories were used to deal with that challenge.

Also, behavioral and social sciences other than personality psychology (e.g., research on motivation and emotion, developmental research, research on group processes as well as identity research in sociology) showed a strong interest in research on self-related con-structs, and by the 1980s, the self had emerged as a central topic of investigation in both psychology and sociology and continues to be one.

Naturally, in sport and exercise psychology, research on self and identity happened with a delay and started to emerge in the late 1980s and the 1990s (Stiller & Alfermann, 2005). Topics of interest mainly included the effect of physical activity, exercise, and sports on self-esteem (e.g., Sonstroem & Morgan, 1989) as well as the structure and as-sessment of the physical self-concept (e.g., Marsh, Richards, Johnson, Roche, & Tremayne, 1994) and athletic or exercise identity (e.g., Brewer, Van Raalte, & Linder, 1993), with a strong focus on the contents of the self.

1.1.2   The meanings of self and identity

Even though the definition and conceptualization of psychological and sociological constructs is often difficult, the self has been particularly tricky, leading Leary and Tangney (2012) to state that "from the beginning, the topic has been bogged down in a conceptual quagmire as muddy as any in the social and behavioral sciences" (p. 3). This is partly due to the fact that "everyone seems to know what it is" (Baumeister & Bush-man, 2017, p. 69), and it doesn't help that a large variety of constructs, processes and phenomena are subsumed under the umbrella term of "self" (e.g., ego, identity, self-concept, self-schema, self-complexity, self-regulation, self-image, self-handicapping, self-esteem, self-enhancement, possible selves, self-awareness). To make it even more difficult, sometimes these terms are used differently even by the same authors and can vary from one study to the next, depending on how self and identity are operationalized. Tesser, Martin, and Cornell (1996) thus refer to a "self-zoo" and Baumeister (1998) concludes that "self is not really a single topic at all, but rather an aggregate of loosely related subtopics" (p. 681).

In an attempt to master this "self-zoo", Leary and Tangney (2012) identified five different uses of the word "self" and its components: (1) self as the total person, (2) self as personality, (3), self as experiencing subject, (4) self as beliefs about oneself, and (5) self as executive agent. While they argue that the first and second use should be avoided because they are also used in everyday language and add to the scientific confusion of the terms, the latter three meanings all have some merits: The self as an experiencing subject is similar to what James (1890) termed the "I", while the self as beliefs about oneself equals James' use of the "Me". The third use taps into the self's function to regulate one's own behavior. What these three uses have in common is that they all deal with processes that require reflexive consciousness, or the capacity for self-reflection. Leary and Tangney (2012) thus define the "self" as "the set of psychological mechanisms or processes that allow organisms to think consciously about themselves" (p. 6). They furthermore recommend to use more precise terms when talking about the self, depending on which of the three uses mentioned above is meant.

Oyserman, Elmore, and Smith (2012) also emphasize the reflexive capacity (thinking, being aware of thinking, and taking the self as an object for thinking) when defining the self. They furthermore deal with the relationship between the three terms self, self-concept and identity. Self-concepts, in their approach, are mental concepts or "cognitive structures that can include content, attitudes, or evaluative judgements" (p. 72), dealing with the "Me" aspect of the self. While the authors make a distinction between self-concept and identity in suggesting that self-concept should be used for broader perspectives (i.e., individualistic vs. collectivistic self-concept) and thus assume that identities are nested within self-concepts (with "self" being on top of the hierarchy), they also acknowledge that other authors treat self and identity as synonyms (e.g., Swann & Bosson, 2010). Although stemming from different theoretical perspectives—with identities being concerned with internalized meanings and expectations associated with the positions and roles one holds in social interaction—Markus and Wurf stated in 1987 already that "psychologists and sociologists are achieving a complete convergence in how they think about the self" (p. 301). Therefore, in the present dissertation, the two concepts are assumed to basically mean the same and are used interchangeably (see chapter 1.3.3 for the relation between the two exercise-related constructs of exercise self-schema and exercise identity).

1.1.3 Content and structure of the self

Much of the scientific debate has dealt with how the self is organized, which, in turn, also influences how the self is defined. When academics first began to engage in research on the self, the construct was seen as an apparently singular, stable, generalized and static entity. However, in their seminal article *The dynamic self-concept*, Markus and Wurf concluded in 1987 already that there seems to be wide consensus about the self being perceived as a multidimensional, multifaceted, dynamic and active structure influencing all kinds of (social) information processing. A number of different models have been proposed to capture the cognitive representation of self-related knowledge. The self has been depicted as single nodes in an associative network (e.g., Bower & Gilligan, 1979; Hannover, 1997, 2000, 2005), as a hierarchical, categorical structure (e.g., Kihlstrom & Cantor, 1984), as a multidimensional space (e.g., Greenwald & Pratkanis, 1984), or as a system of self-schemata (Markus & Sentis, 1982). Although in recent years a growing interest in the self from a neuroscience perspective has emerged, researchers have not been able to pinpoint an exact region in the brain where the self resides (see Beer, 2012, for a review), leaving room for theoretical modeling regarding the structure of the self. In what follows, three models will be presented that can be considered prototypical for modeling the structure (chapter 1.1.3.1) and the processing dynamics of the self system (chapters 1.1.3.2 and 1.1.3.3).

1.1.3.1 A multidimensional, hierarchical model of the self-concept

One model of self-related knowledge is the hierarchical, multidimensional self-concept model established by Shavelson, Hubner, and Stanton (1976). As this model has informed research and empirical evidence in sport and exercise psychology a great deal (Stiller & Alfermann, 2005), it is presented in more detail (see figure 1.1). Shavelson et al. (1976) assume a general self-concept at the top of the hierarchy which can be further differentiated into an academic and a non-academic self-concept. Academic self-concept can be divided into subject-matter areas and then into specific situations within a subject matter. Similarly, the non-acacemic self-concept consists of the social, emotional and physical self-concept, with more specific facets for each of these subdimensions going down to the bottom of the hierarchy.
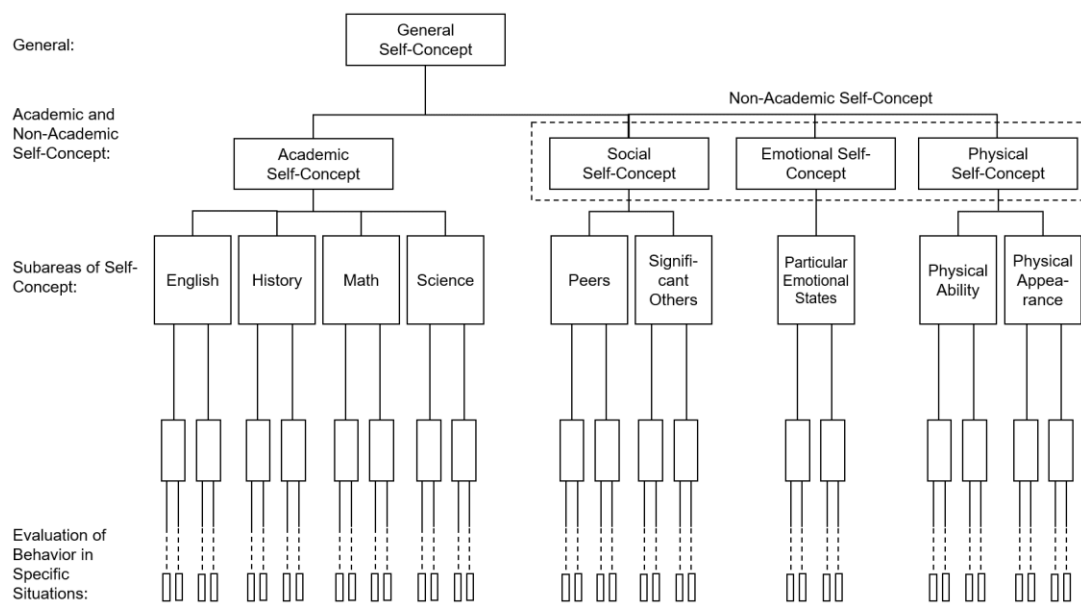
Figure 1.1:   *One possible conceptualization of the hierarchic structure of the self-concept (Shavelson et al., 1976).*

Shavelson et al. (1976) propose several features of the self-concept in this conceptualization, among them that the self-concept is an organized or structured, multifaceted, and hierarchical representation. Besides, they assume that the stability of the self-concept varies greatly, with self-concept areas higher in the hierarchy being more stable than self-evaluations in specific situations. They also suggest that the self-concept is differentiable from other constructs and that for example, the self-concept of academic ability in science should be more closely related to achievement in science than to achievement in other academic domains. While some of these tenets—especially the multidimensional structure—are supported by empirical evidence, for others, the findings are less clear (e.g., Marsh & Yeung, 1998). Subsequent research in sport and exercise psychology has been based on the self-concept model by Shavelson et al. (1976) and questionnaires measuring the physical self-concept have been derived from it, namely the Physical Self-Description Questionnaire (Marsh & Redmayne, 1994) and the Physical Self Perception Profile (Fox & Corbin, 1989). In using these models, the focus of research was on the contents of the (physical) self-concept and on how sport and exercise influence different self-aspects as well as self-esteem (see also the Exercise and Self-Esteem Model, Sonstroem & Morgan, 1989). Several meta-analyses show that sport and exercise do indeed enhance physical and global self-esteem, but the effect is

much smaller than one would expect from a robust association, and the results of empirical studies are highly heterogeneous (e.g., Ahn & Fedewa, 2011; Babic et al., 2014; Campbell & Hausenblas, 2009; Ekeland, Heian, & Hagen, 2005; Ekeland, Heian, Hagen, Abbott, & Nordheim, 2005; Hausenblas & Fallon, 2006; Liu, Wu, & Ming, 2015; Netz, Wu, Becker, & Tenenbaum, 2005; Reel et al., 2007; Spence, McGannon, & Poon, 2005). Afterwards, researchers started to investigate possible moderator variables mainly concerning the type of sport or exercise (e.g., intensity, duration, frequency), but with limited success (e.g., Hänsel, 2012, for a summary). Much less interest in previous research was on characteristics of the person, namely the (cognitive) processes and dynamics of the self (Hänsel, 2008).

1.1.3.2   *The self as a system of self-schemata*

As noted above (chapter 1.1.3), how the self is represented as a cognitive structure has been modeled in different ways. One possibility is to understand the self as a system of self-schemata. Schema theory in social cognition evolved during the 1970s and assumes that social and self-related knowledge is organized in general cognitive structures, so called schemata. These schemata facilitate encoding, memory as well as inference and evaluation of information, and thus information processing in general (Fiske & Taylor, 1991). Hazel Markus (1977) was the first to transfer schema theory to self-concept research. She defined schemata as "cognitive generalizations about the self, derived from past experience, that organize and guide the processing of self-related information contained in the individual's social experiences" (p. 64). These schemata emerge because people are regularly confronted with self-relevant information that needs to be organized, categorized and explained. According to Markus, on an operational level, individuals are called "schematic" for a certain self-aspect if they rate attributes linked to this self-aspect (e.g., adjectives) as very self-descriptive and at the same time as very important to the image they have of themselves. People without a self-schema in a certain self-aspect are called aschematic for this very self-aspect, i.e. they judge attributes linked to that self-aspect as being only moderately self-descriptive and less important to their self-image. Self-schemata can be developed in self-aspects as different as personality traits (e.g., independence, spontaneity, extraversion), areas of life (e.g., being a parent), or specific behavior (e.g., during test situations). Some self-aspects develop into schematic self-aspects for basically everyone (e.g., gender, name, physical appear-

ance)—Markus and Sentis (1982) call these universal self-schemata. Whether other self-aspects (so called particularistic self-schemata) become schematic self-aspects or not (e.g., exercise, chapter 1.3.1) is highly dependent on an individual's social environment, experiences, interests, abilities and so on. In this vain, self-schemata are completely comparable to what Stryker (1968, 1980) called salient identities.

One important characteristic of self-schemata is that they are continuously reinforced by schema-congruent information: "Self-schemata search for information that is congruent with them and direct behavior so that it is commensurate and consistent with them" (Markus & Sentis, 1982, p. 45). This is because the advantages of a facilitated processing of self-relevant information would be lost if these structures changed at each encounter with slightly inconsistent information (Markus & Kunda, 1986). In terms of cognitive representation, this resistance to change can be defined as the extent of connections that self-schemata have with other cognitive representations. However, this assumption has rarely been tested empirically. One exception is a study by Petersen, Stahlberg, and Dauenheimer (2000a) who showed that schematic self-aspects have more important connections to other cognitive representations and that participants judged schematic self-aspects as more difficult to change than aschematic self-aspects. Markus (1977) found that people who are schematic for independence reacted faster to adjectives connected to this personality trait than people who are aschematic for this self-aspect. Besides, unlike aschematics, schematics rejected feedback inconsistent with their self-assessment (i.e., telling people schematic for independence that they are easily suggestible). In summary (e.g., Dauenheimer, 1996; Mittag, 1992; Petersen, 1994), empirical findings show that self-schemata facilitate information processing on a number of different levels: They aid in processing and remembering self-relevant information and in predicting future behavior. They also lead to schema-congruent information being processed preferably and to schema-incongruent information being rejected.

From this perspective, the self-concept is seen as a system of differently elaborated self-schemata (Markus & Sentis, 1982). While universal self-schemata are chronically accessible, other self-schemata are activated depending on the (social) circumstances. This "working self-concept" (also called accessible or online self-concept) accounts for the fact that not all self-representations or identities that are part of the self-concept will be accessible at any given time. It thus can be understood as a "continually active, shifting

array of accessible self-knowledge" (Markus & Wurf, 1987, p. 306). The idea that there is not a "fixed" or "static" self, but rather a "current" self-concept that is continuously constructed from one's own social experiences is really similar to what symbolic interactionists postulate (e.g., Mead, 1934; Stryker, 1980), thus confirming the notion that psychologists and sociologists seem to converge on how they think about the self.

Markus and Wurf (1987) discuss different types of self-representations. First, self-representations can differ in their centrality or importance (e.g., self-schemata, core conceptions, or salient identities): Central self-conceptions are assumed to affect information processing and behavior most powerfully and are generally the most well elaborated self-aspects. According to Gregg, Sedikides, and Gebauer (2011), "a useful definition of identity should encompass only a consequential subset of potential self-construals" (p. 307), namely those that are central (and not peripheral), essential (and not accidental), and important (and not immaterial). In their definition, centrality equals chronically accessibility, whereas essential refers to characteristics such as intrinsic or inevitable and define "what one is". Importance is connected to motivation, i.e., identities matter to people.

Second, self-representations also differ in whether they have been achieved or not. Markus and Nurius (1986) distinguish actual (what one believes about oneself at a given point in time) and possible selves (what one wants to become or is afraid to become). In a similar vein, Higgins (1987) identified ideal and ought selves alongside the actual self. Ideal selves refer to what one hopes or aspires to be, whereas ought selves refer to someone's duties, obligations or responsibilities. Discrepancies between actual and possible selves are thought to result in affective and in turn in behavioral responses (e.g., increased motivation to change a self-aspect in which the discrepancy between actual and ideal self is high).

1.1.3.3   *A psycho-social dynamic processing model of the self*

More recently, Morf and Mischel (2012) developed an integrative model of a comprehensive self-system, drawing on connectionist theory and neural network models. This model is based on what they now consider to be a consensus among researchers on the characteristics of the self (e.g., Swann & Bosson, 2010). These characteristics include (Morf & Mischel, 2012):

- Conscious self-thinking and self-awareness allow an individual to reflect and evaluate their experiences and reactions.
- The self is not only a knowledge structure, but is also a "doer" and "feeler", guided by both affect and cognition.
- The self can at the same time be stable and variable, consistent and inconsistent, rational and irrational, planful and automatic, agentic and routinized.

These complexities and seeming inconsistencies can be accounted for by the fact that the self is (1) "an organized, dynamic cognitive-affective motivated action system" and (2) "an interpersonal self-construction system" (Morf & Mischel, 2012, p. 27). Regarding the first characteristic, the self is organized in that the diverse contents and processes of the self are not isolated components, but form "a coherent organization of mental-emotional (cognitive-affective) representations" (Morf & Mischel, 2012, p. 28). It is dynamic in that it influences and is influenced by information from the social world (see also chapter 1.2), and it is an action system as it generates behavior. Regarding the second characteristic, to understand "who one is" it is essential to study their expression in social interaction.

Morf and Mischel (2012) thus define the self-concept as

> a coherent organization of mental–emotional representations, interacting within a system of constraints that characterize a person (or a type) distinctively. In its complex organization and processing dynamics, the self-system draws as a metaphor on both current connectionist theory and on neural network models. But it also is a motivated, proactive knowing, thinking, feeling action system that is constructed, enacted, enhanced, and maintained primarily in interpersonal contexts within which it develops. Through this organized system the person experiences the social, interpersonal world and interacts with it in characteristic self-guided ways, in a process of continuous self-construction and adaptation. (p. 22)

From this perspective, the self consists of a stable network of so-called units. These units include all kinds of information about one's self, among them self-relevant goals, beliefs, expectancies, values central to the individual, the person's theories about the self, self-relevant affect, and self-esteem. Besides, self-regulatory and self-evaluative standards as well as self-construction competencies and mental representations of scripts for social behavior are also incorporated. These units act on both an automatic

and a volitional level, and while the units themselves can be perceived as stable, the connections between them may vary.

By drawing on connectionist and neural network models, the authors assume that these self-units are organized into distinctive networks for each person, depending on their genetic, biological, and social history, embedded in a particular time and culture. Connectionist processing networks assume that phenomena can be explained by interconnected networks of simple processing units. These units are activated in specific patterns. The nature of these patterns depends on the connection weights between these units (links) and the satisfaction of mutual constraints across these links (Rumelhart & McClelland, 1986). This organization then determines which units become activated together when an individual interacts with the social environment (this is equivalent to the idea of the working self-concept in chapter 1.1.3.2). Activation of the self-systems then "spreads" through the system and across the current cognitive-affective links. Patterns of activation thus "run" the self-system. Therefore, how individuals differ in their self depends on differences in the chronic accessibility of these units (e.g., Higgins, 1996) as well as in their organization and the associations between them (Mischel, 2004). Some units have stronger associations with other units than others and the "spread" of activation is much larger for highly connected units than for units with fewer connections. It is assumed that high elaborateness of certain self-aspects affects information processing (chapter 1.2.4.2).

The psycho-social dynamic processing model of the self described above can hence be considered an extension of the self-schema model presented in chapter 1.1.3.2, if one envisions self-schemata as something similar to units in a network model. Taken together, conceptualization of the self's structure evolved from rather simple, static models to seeing the self as an active, dynamic, adaptive and self-constructional processing system that constantly interacts with information from the social world. However, what this means in terms of operationalization of the self is less clear, as the self is still measured mainly in terms of its contents. While some structural aspects of the self can be assessed using questionnaires or other self-report data (e.g., the subjective importance or centrality of certain self-aspects), the "network analogy" described above is not (yet) directly accessible and thus operationalizable. Therefore, auxiliary constructs or "workarounds" need to be used for operationalization (chapter 1.3).

1.2 Self and information processing

As outlined in the previous chapter, the self is best understood as a dynamic system that actively and constructively organizes and processes self-relevant information. A myriad of empirical studies shows that the self influences how self-related information is processed (see also the findings already presented when the self-schema construct was introduced in chapter 1.1.3.2). Findings from these studies can only be presented here very briefly (for details see Kihlstrom et al., 1988; Markus & Sentis, 1982; Mittag, 1992; Schütz & Sellin, 2003). In general, evidence consistently shows that individuals' perception and attention is enhanced when information is self-related. For example, individuals prefer to attend to information related to their name ("cocktail party effect", "name letter effect", e.g. Moray, 1959; Nuttin, 1985). They also react faster to self-relevant stimuli both in a Stroop test paradigm (e.g., Mathews & McLeod, 1985) and when having to judge adjectives as self-descriptive (e.g., Markus, 1977). A number of studies also show that information processed under a self-referent condition is recalled better than information that is processed under neutral conditions (e.g., self-reference effect; Rogers, 1977; Rogers, Kuiper, & Kirker, 1977). Besides, the structure and content of the self influences the perception of others (Fiske & Taylor, 1991): For example, a woman consistently concerned with her body image and weight might observe other women especially regarding their bodies and their diet.

In the following, I will first discuss different sources that can provide self-relevant information. Then, I will present two influential motivational strategies assumed to guide information processing: self-enhancement and self-consistency strivings (chapters 1.2.3.1 and 1.2.3.2). Variables that moderate whether self-relevant information is processed according to self-enhancement or according to self-consistency principles are described in chapter 1.2.4.

1.2.1 Sources of self-representations

In view of the above, the self is seen as an information processing system. The representations concerning the self thus result from processing self-relevant information. This information can potentially arise from numerous sources (Filipp, 1979):

- *Direct feedback from others*: Self-relevant information can be directly and verbally expressed by others. For example, a physical education teacher might tell a student that the student is a very talented high jumper. Such feedback is inter-

preted subjectively depending on activated self-motives (chapter 1.2.3) and can afterwards be integrated into the self-representation.

- *Indirect feedback from others*: Individuals can also draw conclusions about their self by observing the behaviors of others. For example, a student could conclude that his teacher rates his abilities lowly if he is praised for completing a very easy task (Meyer, 1992).

  - *Social comparisons with others*: Individuals also learn about themselves through social comparisons (e.g., a student compares his performance in high jump with that of his classmates). The role of social comparisons processes for generating self-relevant knowledge is emphasized in social psychological theories such as Festinger's (1954) theory of social comparison processes or social identity theory (Tajfel, 1978; Tajfel & Turner, 1986). The three types of information sources discussed until now are the most relevant in identity theory: Symbolic interactionists in fact suggest that all self-knowledge derives from social interaction (Cooley, 1902; Mead, 1934, chapter 1.1.1).

- *Reflexive information and ideational realization about oneself*: People can also make inferences about their attitudes, emotions, or dispositions while watching their own actions (self-perception or self-monitoring; see also Bem, 1972). For example, individuals might observe physiological reactions (arousal) while talking to someone, or they might watch themselves on video while giving a presentation and then conclude that they look more confident than they thought. Ideational realization focuses on inferences derived from thinking about oneself while drawing on past and future experiences and evaluating oneself from a meta-perspective.

Filipp (1979) assumes that self-relevant information is processed in analogy to other information, drawing on the—later debated—computer metaphor: In the preparation stage, self-relevant information is selected (attentional processes), in the adoption stage, the information is integrated into the internal self-representation, in the storage phase, self-relevant information is archived in memory (e.g., in the form of self-schemata), and in the memory phase, the self-relevant information can be accessed and influences behavior. Filipp therefore was one of the first to link the cognitive information processing paradigm and theories about the self.

Taken together, the structure and content of self-representations is shaped by both the information a person receives about their self (direct and indirect interaction with others, social comparison, reflected appraisals) and by their ability to process this information (see also Markus & Wurf, 1987). In the present dissertation, direct feedback from others is the kind of self-related information that is investigated empirically. How such direct feedback is processed is further discussed in the following chapter.

1.2.2   Processing and acceptance of direct feedback from others

Many theoretical approaches have postulated hypotheses about how individuals process direct feedback from others. Among them are social-cognitive (e.g., conformity of the feedback), cognitive (e.g., perceptions of accuracy), behavioral (e.g., external motivation), cognitive-behavioral (e.g., stages of change) approaches, personality theory approaches (e.g., achievement motivation), and theories of self (e.g., self-efficacy, self-evaluation motives).

In an organizational context, Ilgen, Fischer, and Taylor (1979) developed a model of the effects of direct (performance) feedback on recipients (see figure 1.2). They outlined four steps that individuals go through when they receive a specific type of information, namely self-relevant, direct feedback from others (Ilgen et al., 1979): perception of feedback, acceptance of feedback, desire to respond to feedback, and the intended response. Acceptance of feedback is defined as "the recipient's belief that the feedback is an accurate portrayal of his or her performance" (p. 356), thus the authors' focus is on cognitive, not affective processing of the feedback.

Important for the present dissertation is the notion that the processing of feedback is influenced by characteristics of the source, the stimulus (message) and the person receiving the feedback, thus emphasizing an interactionist approach to information processing. Among characteristics of the source are credibility (expertise), closeness, or personal attraction. The stimulus (message) can differ with regard to the timing, frequency, and valence (i.e., positive, negative) among other things. Finally, on the perceiver's side, frames of reference or "perceptual sets" that are based on past experiences and personality traits influence information processing (Ilgen et al., 1979). Drawing on what was described in chapter 1.1.3, it is assumed that the structure of the self affects how feedback is processed (see also chapter 1.2.4.2). In a similar vein, Garrison (2014) uses the term "mental models" (Johnson-Laird, 1983; Wickens, 1984) to describe "a

cognitive structure, a network of associations between concepts in an individual's mind" (p. 2) that act as a filter for incoming information.
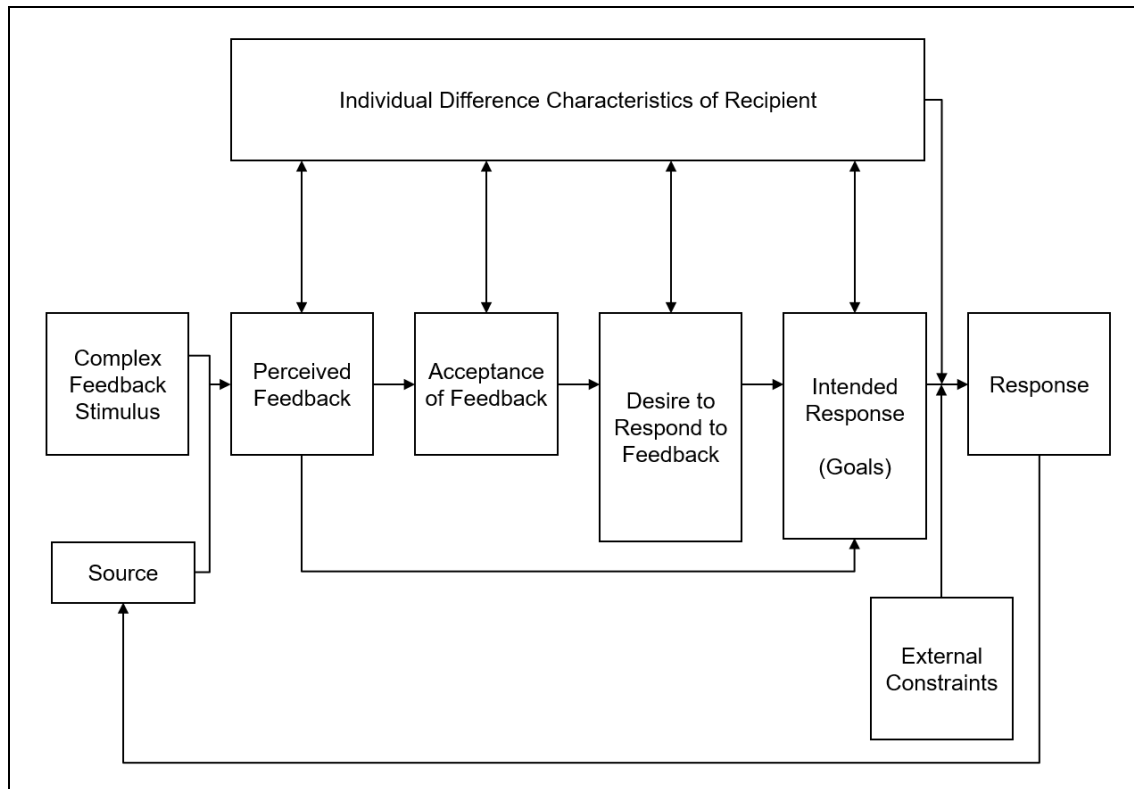
Figure 1.2:   Effects of direct feedback on recipients (Ilgen et al., 1979).

Garrison (2014) summarizes different factors affecting the processing of direct feedback, some of which have already been referred to above. Apart from the characteristics of the feedback source, she identifies self-esteem and self-efficacy, goal orientations (learning goal vs. performance goal) as well as self-directed learning as personality characteristics influencing information processing. She also emphasizes the role of self-views when processing self-relevant information. These factors are discussed in more detail in chapter 1.2.4.2. For the present dissertation, the feedback's valence (or sign; i.e., positive, negative or consistent feedback) is of particular importance. Several authors assume that self-evaluation motives influence whether individuals prefer positive or consistent feedback, namely self-enhancement and self-consistency motives.

1.2.3   Self-evaluation motives

Different motives influence how individuals select self-relevant information, determine its accuracy, draw inferences about themselves, and make plans for the future. Among

the most prominent motives affecting the development, maintenance, and modification of self-views are the self-enhancement and the self-consistency motives[4]. These motives have been discussed both in a self-concept and in an identity framework, further supporting the notion that self and identity are generally commensurate constructs (Gregg et al., 2011; Pemberton & Sedikides, 2001; Sedikides, 1993; Sedikides & Green, 2001; Swann, 1990).

1.2.3.1 Self-enhancement

The roots of self-enhancement theories date back to Allport (1937). Proponents of these theories assume that people generally strive for positive self-evaluations and undertake efforts to maintain a positive sense of self (see Leary, 2007; Sedikides & Gregg, 2008 for summaries). As Swann, Pelham, and Krull (1989) put it, "people strive systematically to promote the perception that others think well of them" (p. 782). Thus, individuals are assumed to seek positive feedback, even if this feedback is inconsistent with their self-view. This implies that people prefer to process positive, self-enhancing information, and reject feedback that threatens their positive self-image. It is sometimes argued that although similar in function, the acceptance of positive feedback (self-enhancement) and the rejection of negative feedback (self-protection) should be considered separately (Sedikides, 2012).

The predictions of self-enhancement theories are supported by a number of empirical findings (see e.g., Alicke, Guenther, & Zell, 2012; Dauenheimer, 1996; Gregg et al., 2011; Hoorens, 1993; Petersen, 1994; Sedikides, 2012; for summaries). For example, the above-average effect relates to the overestimation of one's qualities and abilities in relation to others (Alicke & Govorun, 2005; Brown, 2012). Besides, individuals show a preference for positive information and try to avoid negative or unflattering feedback (e.g., Gaertner, Sedikides, & Cai, 2011; Sedikides & Green, 2001). After having learned they failed in a certain domain-specific test (e.g., intelligence), they compensate by ex-

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[4] A third motive discussed in the literature is self-assessment (Trope, 1983) which refers to improving the accuracy of self-knowledge, regardless of whether positive or negative self-views are at stake. Finally, self-improvement has been considered a possible fourth motive (e.g., Duval & Silvia, 2002; Sedikides & Hepper, 2009), but empirical findings have not been as convincing as for the other three motives. As the self-assessment and the self-improvement motive are of less relevance for the present dissertation, they will not be discussed here in detail.

pressing a predilection for positive feedback in the same or in another domain (e.g., Kumashiro & Sedikides, 2005; Trope & Neter, 1994).

A number of strategies can be subsumed under the self-enhancement motive, for example self-serving attributions (e.g., Campbell & Sedikides, 1999), the (involuntary) strategic choice of social comparison targets (e.g., downward comparisons; Suls & Wills, 1991), self-concept immunization (Greve & Wentura, 2003), or behavioral self-handicapping (e.g., the creation or claim of obstacles in anticipation of failure; Jones & Berglas, 1978; McCrea, 2008; McCrea, Myers, & Hirt, 2009). Self-enhancement strivings lead to a number of psychological and psychobiological benefits: "A positive self-concept and self-esteem … are associated with a host of advantages, including psychological health and longevity, task persistence and achievement, norm adherence and law abidance, satisfying social and interpersonal relationships, and the more effective pursuit of interests or goals" (Sedikides, 2012, p. 338–339).

Self-enhancement strivings have also been investigated in the field of sport and exercise psychology. Three examples are presented here briefly to illustrate that the general principle translates to the sport and exercise context.

Mullen and Riordan (1988) performed a meta-analysis concerning self-serving attributions in the context of sports events. The self-serving attribution bias refers to the tendency to attribute success to dispositional, internal factors (e.g., ability, effort), whereas failure is attributed to external factors (e.g., difficulty, bad luck). The authors found that the results were generally rather heterogeneous across studies, but that on average, a moderate effect of self-serving attributional bias was found for both the general internal-external dimension and the ability dimension. The effects were smaller for the specific attributes of effort, difficulty, and bad luck.

Van Yperen (1992) found evidence for self-enhancing social comparison behavior in major league soccer players. In particular, he investigated the role of ambiguity and non-objective verifiability and the importance/centrality of the dimensions in question (general soccer ability and ability in heading the ball). The more the soccer players judged the dimension in question to be important to them, the more they considered themselves to be superior to others. Besides, they tended to self-enhance more with respect to their (more ambiguous) general soccer ability than with respect to their (more specific and objectively verifiable) heading ability.

Finally, Finez, Berjot, Rosnet, Cleveland, and Tice (2012) examined whether behavioral handicapping in sport situations depends on the level of physical self-esteem. In two studies, they found 1) that self-handicapping is a phenomenon that can be observed in a sport and exercise context, and 2) that athletes with low self-esteem were more inclined to claim handicaps that they could use afterwards to protect themselves from negative feedback than athletes with high self-esteem.

1.2.3.2   Self-consistency theories

Self-consistency theories can be traced back to Lecky (1945) and Festinger's (1957) theory of cognitive dissonance. Today, self-verification theory is the most prominent representative (Swann, 1983, 2011; Swann & Buhrmester, 2012)[5]. Proponents of these theories assume that the self guides both cognition and action of individuals and therefore people strive to confirm their firmly held self-views. These theories propose that people expect to find regularity and are motivated to maximize the extent to which their experiences confirm and reinforce their self-assessments. People are assumed to seek self-verification because self-verifying evaluations contribute to a sense of coherence, conclusiveness and stability of one's behavior. This should lead to their experiences being more orderly and comprehensible which also makes individuals predictable to one another, facilitating social interaction. Self-verification theory is based on the idea of symbolic interactionists that individuals form self-views by observing how others treat them (Swann & Buhrmester, 2012). Over time, they acquire more and more evidence that supports their self-views and thus hold their self-views with increasing certainty. The idea behind self-verification theory is that stable self-views serve important purposes: On the one hand, they guide behavior, on the other hand, they affirm people's sense that things are as they should be.

Self-consistency theories predict that people prefer to process information that is consistent with their own self-assessment, even if that information is negative. Processing

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[5]Swann (Swann, 1990; Swann & Buhrmester, 2012) makes a fine distinction between self-consistency and self-verification theory. According to him, self-consistency theories (e.g. Festinger, 1957) focus on any evidence consistent with one's (even short-lived) beliefs, not on a stable sense of self. On the other hand, the key notion of self-verification theory is that one's enduring self-views are confirmed by consistent information and thus provide an essential source of coherence and continuity. However, the two approaches have been used synonymously by many authors, including Swann himself (e.g., Gregg et al., 2011; Swann, Griffin, Predmore, & Gaines, 1987) and will be used interchangeably in the present dissertation as well.

inconsistent feedback (i.e., feedback that deviates from their own self-assessments in a positive or negative direction) is assumed to lead to cognitive inconsistencies and should therefore be avoided.

The assumptions of self-consistency theories have been confirmed by numerous studies and people use different strategies to self-verify (see e.g., Swann, 2011; Swann & Buhrmester, 2012, for reviews). Swann and Buhrmester (2012) summarize empirical evidence showing that first, individuals process information in a biased way by (1) selective attention processes (e.g., people being more attentive to social feedback when they expect this feedback confirms their self-views), (2) selective encoding and retrieving (e.g., people tend to remember self-confirmatory rather than self-discrepant feedback), and (3) selective interpretation (e.g., people judge a feedback source to be more credible when the feedback is self-verifying). Second, individuals also construct social environments that satisfy their needs by (1) selective interaction with others (e.g., people prefer self-verifying interaction partners), (2) displaying identity cues (e.g., by choosing self-verifying clothes, homes, cars), and (3) interpersonal prompts (e.g., by bringing others to see them as they see themselves). The last point is of special interest for the present dissertation, as it includes effects of compensatory self-verification, i.e. the reaction to inconsistent feedback. Several studies (e.g., Swann & Ely, 1984; Swann & Hill, 1982; Swann & Read, 1981) show that individuals resist and deny disconfirming feedback and that this type of reaction is even more pronounced when self-view certainty is high (see also chapter 1.2.4.2).

In the sport and exercise domain, research on self-consistency strivings is rarer than research on self-enhancement strivings. However, a study by Swann, Kwan, Polzer, and Milton (2003) investigating self-verification effects in group identification processes used sports competence as one possible dimension individuals were rated on by others, suggesting that self-verification principles apply to sport and exercise situations just as they do to other situations.

1.2.4   Variables moderating the dominance of self-evaluation motives

As outlines above, self-enhancement and self-consistency theories make contradicting predictions regarding the preference of feedback: According to self-enhancement theories, individuals are assumed to favor feedback that deviates positively from their own self-assessment, whereas consistency theories state that individuals favor feedback con-

sistent with their self-assessment. A great deal of empirical evidence supports both theories, "with some studies favoring self-consistency theory and others favoring self-enhancement theory" (Swann et al., 1987, p. 882). While proponents of both theories first tried to negate the existence of the respective other theory ("mine is bigger" phase), the convincing empirical evidence supporting either motive led researchers to acknowledge the existence of both principles ("both of ours are big", Swann et al., 1989). A particular advancement was changing the relation between self-view assessment and feedback provided: In early studies, global measures of self-esteem were used for assessing participants' self-views but the feedback provided concerned specific self-aspects. Later, researchers a priori assessed self-views in the very specific domains in which feedback was provided, suggesting that only then the effects of self-verification and self-enhancement will occur ("specificity matching principle"; Swann, Chang-Schneider, & McClarty, 2007). Afterwards, a focus was on identifying variables or conditions under which self-enhancement or self-consistency strivings dominate the processing of self-relevant information, i.e., the search for moderators began (Sedikides & Strube, 1995, 1997; Swann & Schroeder, 1995). From the moderating variables described in the literature (see e.g., Kwang & Swann, 2010; Shrauger, 1975), two will be discussed below which are of particular relevance for the present dissertation.

1.2.4.1 *Type of reaction*

The type of reaction in question was identified relatively early as a potential moderator. Shrauger (1975) as well as Kwang and Swann (2010) found that *affective reaction* generally follows the predictions of self-enhancement theories, i.e., individuals prefer positive as opposed to consistent feedback. Affective reaction refers to liking and disliking the feedback (e.g., happiness, sadness, satisfaction), anxiety, dysphoria, hostility, or mood. For *cognitive reaction*, self-consistency principles are generally more pronounced, meaning individuals cognitively react more positively to consistent compared to positive feedback. Cognitive reaction involves the perceived accuracy of the feedback, the extent to which the feedback is diagnostic and recognized as attributable to oneself, and the competence of the evaluator[6].

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[6] Other than affective and cognitive response discussed here, dependent variables frequently investigated as a function of self-enhancement and self-consistency strivings include behavioral reactions, feedback seeking, and relationship quality (Kwang & Swann, 2010).

Dual-systems theories provide a theoretical reasoning for this finding (Swann, Hixon, Stein-Seroussi, & Gilbert, 1990): It is assumed that the self-enhancement principle operates predominantly on evaluative indices. This means that only the reflexive processing of feedback valence and its potential threat is required. To evaluate feedback one just needs to judge whether it is positive or negative and then can react accordingly. The self-verification principle on the other hand is assumed to operate predominantly on cognitive indices. Therefore it requires more controlled time consuming comparisons of self and feedback. Two steps are thus required in judging the feedback: (1) Is the feedback positive or negative and (2) how does the feedback compare to my self-views? Burke and Stets (2009) convey the idea similarly: "The enhancement response is subject to an 'automatic process', and the consistency response is subject to a 'deliberative process'" (p. 167). Evidence for this theory has been found in an experimental study by Swann et al. (1990) in which individuals who were deprived of time to reflect (cognitive load manipulation), showed preference for self-enhancing feedback.

1.2.4.2 *Elaborateness of the self-aspect in question*

In general, cognitive structures and processes affect feedback acceptance and implementation (Brett & Atwater, 2001; Butler, 1987; Cross & Markus, 1994; Jussim, Soffin, Brown, Ley, & Kohlhepp, 1992; Kinicki, Prussia, Wu, & McKee-Ryan, 2004; Kluger & DeNisi, 1996). A second variable moderating preference for consistent as opposed to positive feedback therefore concerns the *elaborateness of the self-aspect* in question (chapter 1.1.3.2). Self-representations (e.g., self-schemata, identities) can differ in their degree of elaborateness. Highly elaborated self-aspects are strongly connected to a number of other self-aspects (Petersen et al., 2000a). In general, they occupy a central position in the cognitive system (Markus & Wurf, 1987), are more complex and are represented clearly and judged as very self-descriptive. This implicates that highly elaborated self-aspects are quite resistant to change (Markus & Kunda, 1986).

As there is no direct way to measure the elaborateness of self-aspects, auxiliary constructs used to operationalize this structural aspect of the self include self-schemata (Dauenheimer, 1996; Dauenheimer, Stahlberg, & Petersen, 1996, 1997, 1999; Markus, 1977; Petersen, 1994; Petersen & Stahlberg, 1995; Petersen, Stahlberg, & Dauenheimer, 1996, 2000a, 2000b; Stahlberg, Petersen, & Dauenheimer, 1997, 1999), (salient) identities (Burke & Stets, 2009; Stryker & Burke, 2000), and self-certainty (Anseel &

Lievens, 2006; Gross, Holtz, & Miller, 1995; Swann & Ely, 1984). Possible operationalization of the elaborateness of the exercise-related self-aspect is addressed in chapter 1.3.

The idea that the elaborateness of a self-aspect moderates the processing of self-relevant information is informed by two different, but parallel lines of reasoning stemming from sociological as well as social cognitive theories that have only recently begun to be integrated: (1) identity (control) theory rooted in symbolic interactionism, and (2) the integrative self-schema model. Each of these theoretical approaches will be presented now briefly.

A central notion of *identity theory* is that identities provide a set of meanings that serves as a standard or reference for a person. Drawing on early work by Powers (1973), this so-called cybernetic model assumes that after an identity is activated in a given situation, a feedback loop is established that consists of four elements (Burke & Stets, 2009, see figure 1.3): (1) the meanings of the identity (identity standard), (2) reflected appraisals derived from the situation (self-relevant perceptual input such as how one sees oneself and the feedback provided by others), (3) a comparison process between the perceptual input and the identity standard, and (4) some kind of response (output, reaction) to the environment as a result of the comparison process. If an individual observes a difference between the self-meanings from the situation and the self-meanings held in their identity, they try to modify their behavior in order to achieve a congruence between the self-relevant input and the identity standard (Burke, 1991, 1996; Burke & Cast, 1997; Tsushima & Burke, 1999). Identity-verification is achieved when the standard and the self-related input match, i.e., when there is agreement between the meanings of behaviors and self-meanings of the identity standard. On the other hand, if the comparison process leads to perceived incongruences between the self- and the situational meanings, the individuals shows an emotional reaction, namely distress, and will try to alter their behavior in order to accomplish identity-verification. For example, if an individual sees himself as extrovert and perceives that others share this perception, he will continue to act like before (extrovert). But if he recognizes that others seem to see him as rather introvert, he will experience distress and, in turn, will alter his behavior in a direction which he thinks is typical for an extrovert (Burke & Stets, 2009).
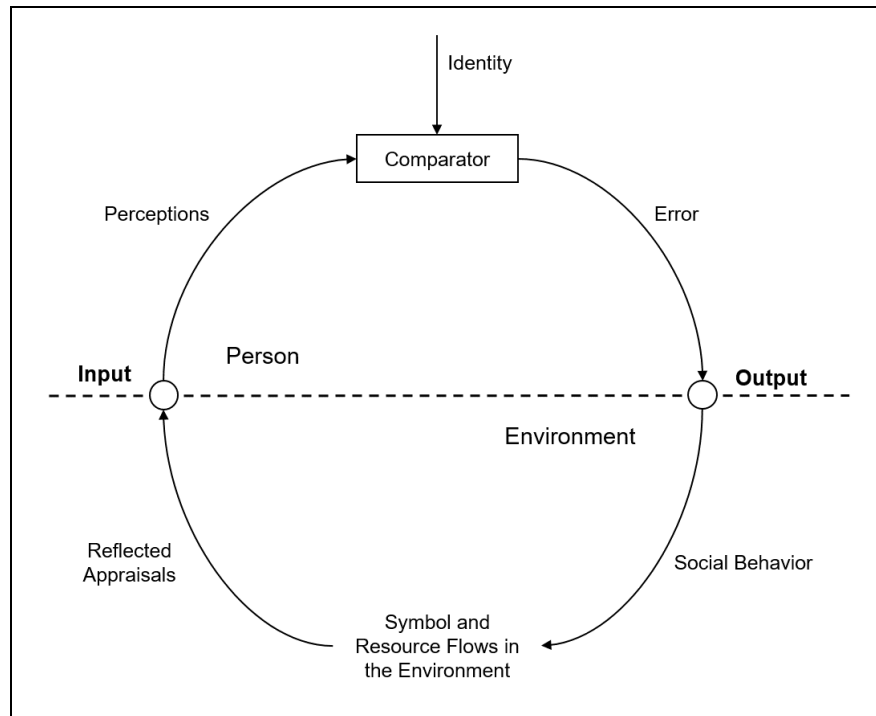
Figure 1.3:   *Cybernetic identity control model (Burke & Stets, 2009, p. 62).*

Proponents of identity theory assume that the striving for identity-verification (or self-verification) is stronger when an individual is highly committed to an identity, i.e., when this identity occupies a central position in the self-system (Burke & Reitzes, 1991). Naturally, commitment to an identity and pressure to strive for congruency between situational meanings and meanings of the identity standard are reciprocally linked. Identities which individuals are highly committed to are also identities that are structurally more tied to other self-relevant attributes (e.g., number of friends connected to that identity; Burke & Reitzes, 1991; Stryker & Serpe, 1982, 1994), equaling the idea that the elaborateness of self-aspects moderates whether self-consistency strivings are more pronounced than when identities are less elaborated. Identity theory has been mainly concerned with behavioral reactions to identity-verification and -nonverification, but other types of reactions, such as affective responses, have been examined as well. For example, Burke and Harrod (2005) found that identity-nonverification results in negative affect. Effects of identity-verification and -nonverification have also been investigated in a sport and exercise setting (chapter 1.3.2).

The *integrative self-schema model* (Dauenheimer, 1996; Dauenheimer et al., 1996, 1997, 1999; Petersen, 1994; Petersen & Stahlberg, 1995; Petersen et al., 1996, 2000a, 2000b; Stahlberg et al., 1997, 1999) makes rather similar predictions to identity theory

concerning the moderating role of the elaborateness of self-representations with regard to information processing. Two minor differences can be noted: While identity control theory is mainly concerned with self-verification and makes no predictions about which kind of information is preferred when commitment to an identity is low, the integrative self-schema model directly contrasts a preference for positive (self-enhancement) or consistent (self-consistency) information or feedback, respectively, depending on the elaborateness of self-aspects. Second, elaborateness of self-aspects is conceptualized not as commitment and number of ties of an identity, but as self-schemata.

The general idea of the integrative self-schema model is that information that is inconsistent with one's self-view can be integrated into self-aspects low in elaboration more easily because these are less resistant to change (chapter 1.1.3.2). People are therefore assumed to use the opportunity to self-enhance by preferring to process information that deviates positively from the image they have of themselves. In contrast, in highly elaborated self-aspects, integrating positive, but inconsistent information should be more difficult because these self-aspects are stable and resistant to change and inconsistent information would lead to cognitive discrepancies. People are therefore expected to prefer consistent feedback to inconsistent feedback even if the inconsistent feedback deviates positively from their self-assessment. The integrative self-schema model does not specifically address reactions to feedback deviating negatively from one's own self-assessment, although both motivational theories (self-enhancement and self-consistency) predict that negative feedback should be devalued—self-enhancement theories because it threatens the self, and self-consistency theories because feedback that deviates from one's own self-view leads to cognitive inconsistencies.

Originally, in the integrative self-schema model, the elaborateness of self-aspects was operationalized by means of self-schemata (chapter 1.1.3.2). If someone is schematic for a certain self-aspect, this equals a high elaborateness of this self-aspect. On the other hand, self-aspects low in elaborateness are called aschematic self-aspects. Petersen et al. (2000a) postulate that schematic self-aspects are quite resistant to change because of the number of connections they share with other self-representations. The authors found empirical evidence for that assumption, and also showed that individuals judge their schematic self-aspects to be more stable and more difficult to change than their aschematic counterparts. This is the underlying assumption of the integrative self-schema

model: Consistent feedback can easily be integrated into the elaborated cognitive structure of schematic self-aspects, whereas inconsistent feedback (whether positive or negative) will lead to cognitive inconsistencies (see also Festinger's, 1957, cognitive dissonance theory and Higgins', 1987, self-discrepancy theory). Individuals are therefore expected to react in line with consistency theories in these self-aspects. On the other hand, people should have no problem integrating inconsistent feedback into their self-views in aschematic self-aspects because these self-aspects are linked less to other cognitions. They are thus expected to use this opportunity for self-enhancement and prefer to process positive feedback compared to consistent feedback.

The basic assumptions of the integrative self-schema model were confirmed in a series of studies (Dauenheimer, 1996; Dauenheimer et al., 1996, 1997, 1999; Petersen, 1994; Petersen & Stahlberg, 1995; Petersen et al., 1996, 2000a, 2000b; Stahlberg et al., 1997, 1999). The self-aspects in question related to traits such as spontaneity, achievement orientation, assertiveness, or masculinity. In a laboratory setting, participants were provided with bogus feedback after they had completed an alleged computer-assisted personality test. Affective (spontaneous emotion, satisfaction with feedback) and cognitive reactions (accuracy of feedback, agreement of feedback with the assessments by well-acquainted others) were assessed afterwards. In general, results showed that—as expected—self-enhancement principles dominated affective reaction concerning aschematic (lowly elaborated) self-aspects (i.e., positive feedback was preferred over consistent feedback), whereas no clear preference for consistent or positive feedback was found for schematic self-aspects. The authors attribute the latter result to the simultaneous impact of self-enhancement (because of affective reaction) and self-consistency principles (because of a highly elaborated self-schema). Likewise, for cognitive reaction—as expected—self-consistency principles predicted reactions for schematic self-aspects (i.e., consistent feedback was judged to be more accurate and diagnostic than positive feedback), but no clear preference for consistent or positive feedback was found for aschematic self-aspects. The latter result is ascribed to the simultaneous impact of self-consistency (because of the cognitive reaction) and self-enhancement principles (because of low elaborateness of the self-aspect in question).

The general idea that the elaborateness of self-views moderates information processing has also been investigated in studies outside of the identity theory and the integrative

self-schema model framework. For example, Bandura (1991) formulated a very similar notion in his social cognitive theory of self-regulation. Korsgaard (1996) found that in an educational setting, students agreed more with feedback concerning a presentation they gave when this feedback matched their previous self-appraisal. The same effect was not found for satisfaction with the feedback, further corroborating the finding that self-consistency principles dominate cognitive, but not affective responses. In a similar vein, Woo, Sims, Rupp, and Gibbons (2008) found that in an organizational context, reactions to assessment center feedback were moderated by the discrepancy between self- and assessor ratings. However, not all studies found support for the moderating role of the elaborateness of self-views on information processing (e.g., Anseel & Lievens, 2006; Bell & Arthur, 2008).

1.3   The elaborateness of the exercise-related self-aspect: Exercise self-schema and exercise identity

As outlined in the previous chapter, both theoretical assumptions and empirical evidence show that the elaborateness of self-aspects moderates whether information is processed in terms of self-enhancement (i.e., preference for positive over consistent feedback) or in terms of self-consistency principles (i.e., preference for consistent over positive feedback). In the field of sport and exercise psychology, the moderating role of the elaborateness of the exercise-related self-aspect in processing self-relevant information that is consistent with or deviates positively from one's own self-assessment has not yet been examined.

Although chapter 1.1.3.3 outlined a plausible theoretical model derived from connectionist and neural network approaches for how the self is structured, it is not (yet) possible to directly measure the kind of interconnectedness and spread between self-related units formulated in this model. Therefore, other types of measures must be used that tap into the notion that highly elaborated self-aspects are judged to be highly self-descriptive, occupy a central position in the self-view, are held with clarity and certainty and are assumed to be resistant to change because of their highly complex cognitive self-representation. The empirical work related to this line of research has typically used measures of self-schema or identity to operationalize the elaborateness of self-aspects (chapter 1.2.4.2). In sport and exercise psychology, two parallel literatures have produced sound measures that could be used to test the moderating role of the elaborate-

ness of self-views in the sport and exercise domain for the first time: exercise self-schema (Kendzierski, 1988, 1990) and exercise identity (Anderson & Cychosz, 1994). Until now, these constructs have mainly been investigated as potential determinants of exercise adherence. I will now briefly present the exercise self-schema and exercise identity (chapters 1.3.1 and 1.3.2) and afterwards explain why it is reasonable to assume that both constructs can be used interchangeably, at least on an operational level (chapter 1.3.3)[7].

1.3.1 Exercise self-schema

The self-schema concept (chapter 1.1.3.2) was first adapted to sport and exercise psychology by Deborah Kendzierski (1988, 1990)[8]. She established the term *exercise self-schema* (sometimes also called exerciser self-schema), which refers to cognitive generalizations about the self based on "an individual's experiences associated with exercise, such as thoughts, feelings, and motor and autonomic responses to exercise" (Sabiston, Whitehead, & Eklund, 2012, p. 231). It is important to note, however, that in order to establish an exercise self-schema, an individual needs not only a host of experience with exercising, but also needs to attach personal importance to this self-aspect.

1.3.1.1 Measurement

Kendzierski (1988) developed a short questionnaire to measure exercise self-schema, sometimes referred to as the Exerciser Self-Schema Scale (Sabiston et al., 2012). In this questionnaire, participants rate whether each of three key phrases *I am someone who exercises regularly*, *I am someone who keeps in shape, I am someone who is physically active* (included among a set of filler items such as *I am someone who is friendly*, *I am someone who is spontaneous*, and *I am someone who consciously sets goals*) describes them on a 11-point rating scale (1 = *does not describe me*, 11 = *describes me*). They also indicate how important the same phrases are to the image they have of themselves,

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[7] As the processing of self-relevant information is directly connected to the assumption that schemata are cognitive generalizations about the self that facilitate information processing (chapter 1.1.3.2), I first drew on the schema construct (study 2, chapter 2.3). However, as will be seen, the schema construct is not without problems in sport and exercise psychology (chapter 2.3.3). Therefore, in study 3 (chapter 2.4), I used the exercise identity construct instead. For the sake of clarity, both constructs will be presented together in this chapter.
[8] Other self-schema constructs that are at least loosely related to exercise, but much more specific, include body weight self-schemata (Markus, Hamill, & Sentis, 1987), body image self-schemata (Girodo, 2003), self-schemata related to healthy eating (Kendzierski, 2007) and dieting behavior (Kendzierski & Whitaker, 1997).

regardless of whether or not the trait describes them (1 = *not at all important*, 11 = *very important*). Depending on the responses, the participants is then categorized into one of four categories:

1. *Exercise schematics* are individuals who rate exercise attributes as highly self-descriptive (at least two of the three items rated with at least 8 points) and at the same time as very important to their self-image (at least two of the three items rated with at least 8 points).

2. *Exercise aschematics* are individuals who rate the items as moderately self-descriptive (at least two of the three items rated with 5 to 7 points) and not extremely important for their self-image (at least two of the three items rated with 7 points or less).

3. *Nonexerciser schematics* judge the items of being not self-descriptive at all (at least two of the three items rated with 4 points or less), but at the same time being very important for the image they have of themselves (at least two of the three items rated with at least 8 points).

4. Individuals who do not meet any of these criteria are categorized as *unclassified participants*.

Unfortunately, in most studies these criteria leave large parts of the sample unclassified and the group of nonexerciser schematics typically is really small in comparison (e.g., Berry, 2006; Berry & Spence, 2009; Estabrooks & Courneya, 1997; Sheeran & Orbell, 2000). The latter is not really surprising as nonexerciser schematics also present a theoretical challenge (Estabrooks & Courneya, 1997; Kendzierski, 1994). Therefore, some researchers including Kendzierski herself (e.g., Kendzierski & Morganstein, 2009; Sheeran & Orbell, 2000) have decided to just differentiate between individuals holding an exercise schema (exercise schematics) and those who don't (exercise unschematics, combining groups 2, 3, and 4 mentioned above). Although no validated German version of the Exerciser Self-Schema Scale has been published, the translation of the three phrases included in the scale seems rather unproblematic, especially as traditional psychometric criteria (e.g., Cronbach's alpha) are not applicable due to the participants' categorization.

1.3.1.2 Empirical findings

Subsequently, other researchers conducted studies using the construct, with most of them exploring the influence of exercise self-schema on exercise-related cognitions and exercise behavior. Specifically—and unsurprisingly—exercise self-schema has consistently been linked to exercise behavior, measured both by self-report and objective data (e.g., Beacham et al., 2011; Estabrooks & Courneya, 1997; Kendzierski, 1988; Thomas, Vanness, & Cardinal, 2016; Yin & Boyd, 2000). Exercise schematics also are more likely to start an exercise program than individuals without an exercise self-schema (Kendzierski, 1988, 1990) and whether individuals are schematic for exercise or not moderates the gap between intentions and exercise behavior (Banting, Dimmock, & Lay, 2009; Estabrooks & Courneya, 1997; Sheeran & Abraham, 2003; Sheeran & Orbell, 2000). Besides, the self-regulation of exercise is also associated with exercise self-schema: Among other things, exercise schematics display higher exercise-related self-efficacy (Beacham et al., 2011; Yin & Boyd, 2000) and a more positive attitude towards exercise (Yin & Boyd, 2000), they intent to exercise more likely in the future (Estabrooks & Courneya, 1997; Yin & Boyd, 2000), and are more committed to exercise (Kendzierski, 1988) than unschematics. Besides, they are more likely to attribute exercise lapses to less stable causes than individuals without exercise self-schema (Beacham et al., 2011; Kendzierski, & Morganstein, 2009; Kendzierski & Sheffield, 2000).

Concerning information processing, Kendzierski (1990) reproduced Markus' (1977) finding that exercise schematics are faster to judge exercise-related stimuli as self-descriptive compared to people without exercise self-schema. Additionally, Berry (2006) demonstrated that exercise schematics show an attentional bias for exercise stimuli in a Stroop test. They also had greater positive bias toward exercise-related stimuli in an Implicit Association Test (Berry, Spence, & Clark, 2011) than unschematics.

To my knowledge, whether being schematic for exercise moderates if self-related information is processed in terms of self-enhancement or self-consistency principles has not been investigated to date.

1.3.2 Exercise identity

Identities are thought to be subcomponents of a multidimensional self-concept representing the self in the context of a particular role (Burke & Stets, 2009). These role

identities are driven by the social nature of past experience and link a person's concept of self to society, i.e., they are influenced by the individual's perceived feedback about their behavior from society (Stryker & Serpe, 1982). Taken together, several role identities then form a complex, but organized integration of beliefs, values, self-perceptions, and behaviors into a recognizable "self-package" that is formed through social interactions (Fox, 1997, see also chapter 1.1.2).

Exercise identity, then, is the identity associated with the role of being an exerciser and is defined as "the salience of an individual's identification with exercise as an integral part of the concept of self" (Anderson & Cychosz, 1994, p. 747). Identities and behavior are assumed to be reciprocally related (Burke & Stets, 2009): Exercise identity is derived from, and gives meanings and value to past experience with exercise, but also guides future exercise behavior and therefore is an important predictor of exercise engagement (Anderson & Cychosz, 1994; Stets & Burke, 2003). Burke and Stryker think of identities as self-regulation control systems linking identity to behavior through variables such as affect, intentions, and efficacy beliefs (Burke, 1980; Stryker, 1980; Stryker & Burke, 2000). As individuals behave in accordance with, or act out aspects of the role of exerciser, the exercise identity may, through social interaction, become a valued and important aspect of one's self-concept (Anderson & Cychosz, 1995). Continued involvement in exercise thus leads to reinforcement and validation of one's exercise identity.

The strength or salience of a given identity can vary between individuals (Burke & Stets, 2009; Stryker, 1980). The stronger an identity is endorsed, or the more a person considers a certain role to be important to the self, the more likely it is that an individual will engage in identity-relevant behavior (Stryker & Burke, 2000; Stryker & Serpe, 1982). Therefore, stronger exercise identity should be linked to engagement in exercise, and should increase the likelihood that the individual will continue to exercise in the future. For instance, individuals who identify with exercise may have internalized the expectations that they engage in exercise regularly, have friends with whom they discuss their exercise involvement, and purchase exercise apparel. However, what it means to identify as an exerciser in terms of behavioral manifestations can vary greatly between individuals (Strachan, Perras, Forneris, & Stadig, 2017). For example, while some individuals might confirm their role identity by exercising at the gym daily, for other indi-

viduals a run once a week might be consistent with their perception of themselves as an exerciser.

Within individuals, identities are assumed to be relatively stable constructs that change only when a given identity is constantly threatened (Burke, 2006, see also chapter 1.2.4.2). Individuals who identify strongly with being an exerciser seek to confirm or verify this identity and to behave consistently with the internalized role meanings (Stets & Burke, 2003), that is, expectations associated with the role identity of an exerciser. A strong exercise identity therefore motivates behavior consistent with that identity.

1.3.2.1   Measurement

Most of the research on exercise identity has used the Exercise Identity Scale (EIS) originally developed by Anderson and Cychosz in 1994, based on the assumed reciprocal relationship between role identities and exercise behavior. The EIS has since been translated to Greek (Vlachopoulos, Kaperoni, Moustaka, & Anderson, 2008), Spanish (Modroño, Guillén, & González, 2010), and Chinese (Hsu & Lu, 2010). A validated German translation is currently not available and to provide one is one of the aims of the present dissertation (chapter 2.2). The EIS consists of 9 items (e.g., "I consider myself an exerciser")[9] to be rated on a 7-point Likert format from 1 = *strongly disagree* to 7 = *strongly agree*.

The authors report strong internal consistency (α = .94) and test-retest reliability (r = .93; Anderson & Cychosz, 1994). Evidence for the construct validity of the EIS is also provided, e.g. positive associations with self-reported exercise behavior (Anderson & Cychosz, 1994; Anderson, Cychosz, & Franke, 1998, 2001). Furthermore, Cardinal and Cardinal (1997) showed that the EIS is able to detect changes in exercise identity in a longitudinal setting. Preliminary norms for the EIS have been established (Anderson et al., 2001).

In recent years, some controversy has arisen regarding the dimensionality of the scale. Exploratory factor analyses described in the literature collectively yielded support for a unidimensional factor solution, explaining around 65 to 80 percent of the variance (e.g., Anderson & Cychosz, 1994; Anderson et al., 1998; Hsu & Lu, 2010; Modroño et al., 2010; Vlachopoulos et al., 2008). For the Greek version, Vlachopoulos et al. (2008)

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[9] The complete scale can be found within study 1 (appendix A).

demonstrated configural and partial metric factorial invariance across sex and culture (Greece vs. USA) for this one-factor model. However, Wilson and Muon (2008) found support for a better fitting two-factor structure, comprised of a Role Identity and an Exercise Beliefs factor. The authors based this two-factor model mainly on empirical evidence by inspecting the modification indices of the unidimensional CFA model, which showed poor to acceptable fit to the data in their study . The Role Identity factor consists of three items and is thought to reflect the "salience with which the role of being an exerciser has been assimilated into one's identity" (Wilson & Muon, 2008, p. 126), whereas the six-item Exercise Beliefs factor deals with "relevant beliefs about exercise previously linked with the salience and strength of identity perceptions" (Wilson & Muon, 2008, p. 126). Murray, McKenzie, Newman, and Brown (2013), however, raise some doubts about the distinct allocation of the items to these factors. For example, they argue that item 4 (*Physical exercise is a central factor to my self-concept*) may represent role identity better than exercise beliefs, and that "it is difficult to state categorically that the exercise role identity factor is a stronger measurement of identity than exercise beliefs" (p. 377). Subsequent research using CFA has found better model fit for the two- than for the one-factor model (Murray et al., 2013; Vlachopoulos, Kaperoni, & Moustaka, 2011), albeit with high correlations between the two factors ($r = .84$–$.88$), which suggests a high level of redundancy between the two factors. Reifsteck, Gill, and Labban (2016) demonstrated that a revised one-factor CFA model that allowed two of the items to correlate (residual covariance) fit the data as well as the two-factor model, and that this added correlation may be attributable to the wording of these two items which "seem to convey very similar meanings" (p. 30). Murray et al. (2013) thus argue that the construct may in fact be unidimensional, and that the two factors may emerge due to item format effects.

In fact, many researchers have continued to use the EIS as a unidimensional measure in their studies even after publications showing empirical support for the two-factor model (e.g., Cook et al., 2015; Lu et al., 2012; Perras, Strachan, & Fortier, 2016; Strachan, Brawley, Spink, Sweet, & Perras, 2015; Strachan, Fortier, Perras, & Lugg, 2013; but see Berry & Strachan, 2012 as well as Murray et al., 2013 for exceptions). Further examination of the scale's factor structure is thus necessary and warranted (Murray et al., 2013).

1.3.2.2 Empirical findings

In general, research has shown that identity theory is useful for predicting behavior, e.g., religious identity predicts commitment to religious activities (Stryker & Serpe, 1982), or blood donor identity predicts number of blood donations (Callero, 1985). In a similar vein, research on exercise identity suggests that seeing oneself as an exerciser is not only related to exercise behavior, but also to a number of motivational, cognitive, and affective variables linked to the self-regulation of exercise.

Unsurprisingly, and in line with the aforementioned assumed reciprocal relationship of role identity and behavior, initial research has found positive relations between exercise identity and exercise behavior. This includes self-reported duration of exercise behavior, minutes of exercise per week, perceived exertion, as well as physiological indicators such as body fat and VO_2max (e.g. Anderson & Cychosz, 1994; 1995; Anderson et al., 1998, 2001; Strachan, Brawley, Spink, & Jung, 2009; Wilson & Muon, 2008). Stronger links have been found for vigorous than for mild forms of exercise (Vlachopoulos et al., 2008). It has also been shown that exercise identity increases after an exercise intervention (14-week exercise program; Cardinal & Cardinal, 1997).

Furthermore, research suggests that exercisers and nonexercisers (Anderson et al., 2001) as well as adolescent athletes and non-athletes (Soukop, Henrich, & Barton-Weston, 2010) differ in their exercise identity strength.

Several studies have shown positive associations between exercise identity and exercise-related self-efficacy (e.g., Petosa, Suminski, & Hortz, 2003; Strachan & Brawley, 2008; Strachan, Flora, Brawley, & Spink, 2011; Strachan, Perras, Brawley, & Spink, 2016; Vlachopoulos et al., 2008), intentions to exercise (Strachan & Brawley, 2008), and exercise enjoyment (Vlachopoulos et al., 2008; Wininger & Pargman, 2003).

Exercise identity has also been linked to self-determination theory (Deci & Ryan, 2002). Both lines of research "share a common focus on the self, identity, motivation, and self-regulation of behaviour" (Strachan et al., 2013, p. 275) and attempt to explain exercise adherence. Consistently, the more self-determined regulations outlined in self-determination theory (identified, integrated, and intrinsic motivation) have been shown to be positively associated with exercise identity, whereas the non-self-determined types of behavioral regulation (amotivation, external regulation) have shown no or negative correlations with exercise identity strength (Reifsteck et al., 2016; Strachan et al., 2013;

Vlachopoulos et al., 2011). Also, endorsing exercise as a salient part of one's identity is positively associated with greater fulfillment of competence, autonomy, and relatedness needs within exercise, which also supports predictions of self-determination theory (Wilson & Muon, 2008).

On the other hand, a strong exercise identity has also been associated with negative outcomes such as exercise dependence (Cook et al., 2015; Lu et al., 2012; Murray et al., 2013), as well as unhealthy eating attitudes and the persistence to train through injury even if the effects are potentially harmful in ultramarathon runners (Lantz, Rhea, & Mesnier, 2004).

Identity theory predicts that individuals seek a consistency between the endorsed identity and their behavior, a notion which is vital for the present dissertation (Stets & Burke, 2003; chapter 1.2.4.2). Strachan and colleagues have shown support for this assumption, as high exercise identity individuals showed less positive and greater negative affect when confronted with hypothetical (Strachan & Brawley, 2008; Strachan et al., 2011; Guérin, Strachan, & Fortier, 2018) and real-life threats to their exercise identity (Strachan et al., 2009; Strachan et al., 2016) than their weaker exercise identity counterparts. Besides, they reported a higher ability to self-regulate their exercise behavior (self-efficacy, intentions to exercise) when confronted with challenges to continue their identity-relevant behavior. Also, exercise identity strength predicted shame and guilt after an exercise lapse (Flora, Strachan, Brawley, & Spink, 2012), thus confirming the predictions of both identity control theory and the integrative self-schema model regarding affective reaction to identity threats (chapter 1.2.4.2). Concerning direct feedback from others, Strachan, Stadig, Jung, and Semenchuk (2018) showed that individuals who identified with being an exerciser and were provided with negative (non-verifying) feedback by others reported more negative and less positive effect, a greater desire to self-represent differently, more public disagreement with feedback and more feedback rationalization than individuals who received consistent (verifying) feedback. Taken together, these studies show that exercise identity appears not only to be consistently related to exercise behavior, but also to social cognitive and affective variables central to the regulation of exercise. In particular, exercise identity strength moderates affective and self-regulatory responses to perceived threats or challenges to exercise identity-

behavior consistency: The more individuals identify with being an exerciser, the more they want to confirm this identity by showing identity-congruent behavior.

1.3.3 Exercise self-schema and exercise identity as commensurate constructs

Although originating from different theoretical backgrounds, there is substantial conceptual overlap between self-schema and identity theory in that the "self-as-exerciser" (Mullen, 2011) is the core subject matter for both constructs (Strachan & Whaley, 2013). This is also a result of the converging notion of the self by self-concept and identity researchers (Gregg et al., 2011; Markus & Wurf, 1987; Oyserman et al., 2012; see also chapter 1.1.2).

More recently, researchers have begun to link the parallel literatures concerning exercise self-schemata and exercise identity. In 2014, Berry, Strachan, and Verkooijen showed that empirically, the two constructs were highly correlated, indicating that "those who held the idea of being an exerciser as central to their self [i.e., exercise schematics], also strongly identified as exercisers" (p. 13). While the authors emphasize the conceptual similarity between the two constructs, they also found that schema and identity each accounted for unique variance in the prediction of intention strength, instrumental attitudes, and affective attitudes. However, it must be noted that they took the two-factor model of the EIS as a basis (chapter 1.3.2.1), which means they considered role identity and exercise beliefs separately.

In 2016, Rhodes, Kaushal, and Quinlan published a meta-analysis and review summarizing the current state of research regarding exercise self-schema and exercise identity. For the association between schema/identity and behavior, they found a moderate effect size of $r = .44$ (95% CI = .39−.48). Summing up the findings presented above (chapters 1.3.1.2 and 1.3.2.2), they show that exercise self-schema and exercise identity, respectively, are related to commitment to exercise, perceived ability, affective judgements (e.g., enjoyment, affective attitude), identified/integrated regulation as proposed by self-determination theory, social comparison processes (i.e., the self-as-exerciser is formed at least partially by comparing oneself to others) and predicted intention to engage in physical activity, self-regulatory efficacy (e.g., goal persistence), and self-regulation strategy use (e.g., planning and monitoring of behavior). Besides, the self-as-exerciser (schema/identity) consistently moderates the intention-behavior relationship, is linked to

a faster processing of self-relevant information and leads to negative affect after identity-behavior discrepant situations.

Rhodes et al. (2016) conclude that exercise self-schema and exercise identity are therefore generally commensurate constructs and that "measurement and operationalization of the construct as an identity or schema is relatively negligible" (p. 218).

I therefore assume that whether the elaborateness of the exercise-related self-aspect is operationalized in terms of exercise self-schema or exercise identity does not really matter. This is why—consistent with the integrative self-schema model, from which the hypotheses were originally derived—I first used exercise self-schema as a means of operationalizing the elaborateness of the exercise-related self-aspect (chapter 2.3). In the next study (chapter 2.4), I drew on exercise identity instead, for reasons discussed in chapter 2.3.3. However, as no German version of the scale was available, the EIS first had to be translated. In order to present the two studies dealing with the moderating role of the elaborateness of the exercise-related self-aspect consecutively, I will summarize the study dealing with the translation and validation of the EIS first (chapter 2.2).

1.4 Research Questions and Hypotheses

The theoretical background and empirical evidence presented above can be summarized as follows:

- By now, there is considerable consensus among sociologists and social psychologists that the terms self and identity can be used interchangeably and refer to the capacity of self-reflection (chapter 1.1.2).
- Self/identity is best understood as a coherent system of self-related representations. At the same time it is a dynamic, active and self-constructional processing system constantly interacting with the social, interpersonal world. Individuals differ in both the organization and the links between cognitive representations (chapter 1.1.3.3).
- Self/identity and information processing are reciprocally connected. A number of studies show that people process self-related information differently from other information (e.g., perception, attention, memory; chapter 1.2).
- Different self-evaluation motives guide information processing, the most prominent being self-enhancement strivings (i.e., preference for positive feedback; see

chapter 1.2.3.1) and self-consistency strivings (i.e., preference for consistent feedback; chapter 1.2.3.2).

- Variables that have been shown to moderate information processing (self-enhancement vs. self-consistency) include the type of reaction (i.e., affective responses follow self-enhancement principles and cognitive responses follow self-consistency principles) as well as the elaborateness of the self-aspect in question (i.e., responses to information in highly elaborated self-aspects follow self-verification principles, whereas responses to information in lowly elaborated self-aspects follow self-enhancement strivings; chapter 1.2.4). The latter moderator variable is informed both by social cognition theories and by identity theory.

- In sport and exercise psychology, research on the self has focused strongly on contents of the self and on associations between exercise and physical self-concept or global self-esteem. The general assumption that sport and exercise lead to more positive self-evaluations cannot be confirmed on a global level (chapter 1.1.3.1).

- Characteristics of the person (i.e., self-related variables and cognitive processes) have barely been addressed in sport and exercise psychology. In particular, the moderating role of the elaborateness of self-representations on the processing of self-relevant exercise-related information has, to my knowledge, never been addressed (chapter 1.3).

- The exercise self-schema and exercise identity constructs can be seen as generally commensurate and can be used to capture the elaborateness of the self-as-exerciser (chapter 1.3). The self-schema construct will be used in study 2, and the identity construct will be used in study 3 (chapter 2.3.3). However, while operationalization of exercise self-schema is relatively easy as it only uses three short phrases (chapter 1.3.1.1), the use of the EIS in a German sample needs a validated translation first. Besides, the factor structure of the EIS is currently subject of debate and it is unclear whether exercise identity is best represented as a unidimensional or as a two-dimensional construct (chapter 1.3.2.1).

Therefore, the aim of the present dissertation was twofold: First, I wanted to test whether the elaborateness of the exercise-related self-aspect (i.e., exercise self-

schema/exercise identity) moderates the processing of self-relevant information, and consequently, whether self-relevant information is processed according to the predictions of self-enhancement (i.e., preference for positive compared to consistent feedback) or self-consistency theories (i.e., preference for cognitive compared to positive feedback), depending on the elaborateness of the exercise-related self-aspect. In doing so, I distinguished reactions to self-relevant feedback that either mirrored the participants' self-assessments (i.e., consistent) or deviated from their self-assessments in a positive direction. To establish a comparability with studies investigating the integrative self-schema model (chapter 1.2.4.2), I also included a negative feedback condition (feedback deviating negatively from participants' self-assessment), but formulated no specific hypotheses for reactions to negative feedback. As type of reaction (affective vs. cognitive) has been shown to influence whether self-enhancement or self-consistency principles dominate information processing, I take into account type of reaction as well. Affective and cognitive reactions will be examined separately.

This means it is possible that the two variables considered (type of reaction and elaborateness) make contradicting predictions and therefore self-enhancement and self-consistency strivings co-occur and cancel each other out. In this case, I assumed that there would be no difference in reaction to consistent as opposed to positively deviating feedback. Therefore, for study 2 and study 3 (chapters 2.3 and 2.4), the following hypotheses were formulated.

H1: Concerning *affective reaction*, individuals with a less elaborated self-as-exerciser prefer exercise-related feedback deviating positively from their own self-assessment as opposed to consistent feedback (because self-enhancement is expected due to both affective reaction and low elaborateness), while individuals with a highly elaborated self-as-exerciser don't show a clear preference for either consistent or positively deviating feedback (because self-enhancement is expected due to affective reaction and self-consistency is expected due to low elaborateness).

H2: Concerning *cognitive reaction*, individuals with a highly elaborated self-as-exerciser prefer exercise-related feedback consistent with their own self-assessment as opposed to feedback deviating positively from their self-assessment (because self-consistency is expected due to both cognitive reaction and high elaborateness), while individuals with a less elaborated self-as-exerciser don't show a clear preference for either consistent or positively deviating feedback (because self-consistency is expected due to cognitive reaction and self-enhancement is expected due to low elaborateness).

A secondary aim of the present dissertation was to provide a sound and psychometrically valid German translation of the EIS (study 1, chapter 2.2). In doing so, I also want to add to the literature by suggesting a bifactor model as a possible alternative to the previously discussed one- and two-factor models of the EIS.

More specifically, three studies were conducted with the following goals:

Study 1:

The key objective of study 1 was to obtain a valid instrument for assessing exercise identity in German-speaking samples so that the above-mentioned hypotheses can be investigated later. As the EIS (Anderson & Cychosz, 1994) is not available in German, a sound translation including the validation of this new version was warranted. Study 1 therefore extends previous empirical evidence by

- providing a sound German translation of the EIS,
- introducing a bifactor structure as a possible alternative to the previously discussed one- and two-factor models underlying the EIS (factor structure),
- testing temporal invariance across a time period of 14 days,
- testing measurement invariance across men and women, and
- examining convergent and discriminant validity of the German translation.

Study 2:

In study 2, the primary aim was to test the hypotheses formulated above in an online experiment. Drawing on the integrative self-schema model, exercise self-schema (Kendzierski, 1988) was used as a means for operationalizing the elaborateness of the self-as-exerciser. Also, on principle, the design of the study was based on the procedures

used in studies testing the assumptions of the integrative self-schema model (e.g., Petersen, 1994).

Accordingly, a study was conducted that adds to the literature by

- investigating the moderating role of the elaborateness of the exercise-related self-aspect on the processing of self-relevant information for the first time,
- using exercise self-schemata as a means to capture the elaborateness of self-views, transferring the integrative self-schema model to the sport and exercise domain, and
- examining affective and cognitive reactions to self-related feedback in six different dimensions related to exercise (e.g., physical fitness, health, physical appearance).

Study 3:

Study 3 builds on study 2 by retesting the central hypotheses of this dissertation in a laboratory setting. Contrary to study 2, the elaborateness of the self-as-exerciser was operationalized using the exercise identity construct by means of the German translation of the EIS (see study 1). Specifically, the main contributions of study 3 are to

- conceptually replicate the findings of study 2 in an independent sample,
- enhance the credibility of the given feedback by basing feedback on a "real", allegedly more objective test than was possible in the online setting of study 2,
- provide feedback that is directly associated with the self-aspect in question (i.e., physical fitness feedback is assumed to be central for individuals with strong exercise identities),
- use (continuous) EIS scores as a means of the elaboratenesss of self-views as opposed to the dichotomous self-schema categorization used in study 2, and
- enhance the reliability of the dependent measures (affective and cognitive reaction) by using scales with more items than in study 2.

2 Empirical Studies

This chapter provides a brief overview over important methodological considerations, most central results, and conclusions of all three empirical studies. For further details, the reader is referred to the original manuscripts in appendices A to C of this thesis. The studies will not be presented chronologically for the sake of clarity. Instead, I start by summarizing the study dealing with the translation and validation of the EIS (chapter 2.2). Afterwards, I outline the two studies tackling the primary research question, using the exercise self-schema construct in study 2 (chapter 2.3) and the exercise identity construct in study 3 (chapter 2.4) as measures of the elaborateness of the exercise-related self-aspect.

2.1 Overview of dissertation-relevant manuscripts

The present cumulative dissertation is based on the following publications:

Publication I

Ennigkeit, F., & Hänsel, F. (2018). Factorial and convergent validity of the Exercise Identity Scale in a German adult sample. *Measurement in Physical Education and Exercise Science*. Advance online publication. doi:10.1080/ 1091367X.2018.1474113

Publication II

Ennigkeit, F., & Hänsel, F. (2014). Effects of exercise self-schema on reactions to self-relevant feedback. *Psychology of Sport and Exercise, 15*, 108–115. doi:10.1016/ j.psychsport.2013.10.008

Publication III

Ennigkeit, F., Hänsel, F., & Heim, C. (2018). Does exercise identity moderate affective and cognitive reactions to feedback on physical fitness? *Psychology of Sport and Exercise, 37*, 10–18. doi:10.1016/j.psychsport.2018.03.008

2.2 Study 1: Factorial and convergent validity of the Exercise Identity Scale in a German adult sample

Most of the research on exercise identity has used the EIS (Anderson & Cychosz, 1994, see chapter 1.3.2.1 for details). This 9-item scale has since been translated to Greek (Vlachopoulos et al., 2008), Spanish (Modroño et al., 2010), and Chinese (Hsu & Lu, 2010). In order to be able to assess exercise identity in a German sample, the aim of the first study was to translate the EIS to German and test the reliability and the construct validity of the German version. In doing so, a special focus was on the factor structure of the scale, as previous research has found heterogeneous results, supporting either a unidimensional or a two-factor structure. Wilson and Muon (2008) were the first to make an argument for two factors, namely *Role Identity* (3 items) and *Exercise Beliefs* (6 items). We alternatively suggest a bifactor model which "specifies that the covariance among a set of item responses can be accounted for by a single general factor that reflects the common variance running among all scale items and group factors that reflect additional common variance among clusters of items, typically, with highly similar content" (Reise, 2012, p. 668).

The first study therefore pursued five aims:

1. to translate the EIS into German,

2. to test the factorial validity of the translated version by comparing the two previously discussed one- and two-factor models to a newly introduced bifactor model as an alternative,

3. to analyze stability of the internal structure by investigating temporal invariance over a time interval of 14 days,

4. to investigate whether the German EIS items are invariant across men and women,

5. to demonstrate convergent and discriminant validity by investigating relations to similar and discriminant constructs.

2.2.1 Methods

The translation procedures were based on recommendations for cross-cultural research and involved the preparation of preliminary versions that were back-translated into English, the evaluation of the preliminary versions and the preparation of a so-called "experimental version" as well as pretests of this experimental version (Banville,

Desrosiers, & Genet-Volet, 2000; Hambleton, 2005). A sample of $N = 530$ individuals (65% female; 51% university students; 72% regular exercisers) between 15 and 75 years of age ($M = 30.5$ years, $SD = 12.1$) participated in the online study. Apart from exercise identity, we assessed exercise self-schema, exercise self-efficacy, perceived sports competence, physical self-worth, exercise behavior and social desirability in order to examine construct validity of the EIS. A subsample of $n = 221$ individuals provided answers to the EIS a second time approximately 14 days later (retest sample).

Data were analyzed by means of confirmatory factor analysis using conventional fit indices. For model comparisons and invariance testing across sex, chi square difference tests and change in CFI were examined. Temporal invariance testing was investigated using latent state models with autocorrelated error variables. Convergent and discriminant validity was analyzed using manifest correlations between EIS scores and the validation scales, and difference tests (t-tests, analysis of variance) between distinct groups with regard to their exercise identity strength, respectively.

2.2.2 Results

Regarding the factor structure, confirmatory factor analyses revealed that the one-, two- and bifactor model all exhibited acceptable (RMSEA) to good (CFI, TLI, SRMR) model fit. Chi square difference testing suggested that the data was represented best by the bifactor model. Despite that, further examination of the relation between the general and the group factors (factor loadings, explained common variance, omega hierarchical) indicated that treating the Role Identity and the Exercise Beliefs factor separately as group factors does not seem justified. The two-factor model fit the data significantly better than the one-factor model. However, the two-factor model was characterized by a near perfect correlation between the two factors ($r = .98$), indicating such substantial overlap that the more parsimonious one-factor model was to be preferred. The unidimensional model was thus retained as the final model.

Temporal configural, metric, and scalar invariance of EIS scores could be demonstrated, suggesting that neither the factor structure nor the factor loadings nor the intercepts of the model did change significantly during a period of approximately two weeks.

Metric and scalar measurement invariance across men and women could not be demonstrated by means of chi square difference testing, but all models showed good model fit

indices and change in CFI was minimal. Invariance of the factor structure across sex can therefore be assumed.

With regard to convergent validity, we found strong manifest associations between EIS scores and measurements of exercise self-schema (with individuals schematic for exercise exhibiting higher EIS scores), exercise behavior (strenuous exercise behavior, stage of exercise adoption), exercise self-efficacy, and perceived sports competence. Exercise behavior as measured by hours per week and physical self-worth were moderately correlated with EIS scores. There was no association between exercise identity and social desirability, suggesting discriminant validity.

2.2.3   Discussion

Study 1 resulted in a successful translation of the EIS into German. Apart from temporal invariance, measurement invariance across men and women as well as convergent and discriminant validity could be demonstrated. Besides, the study extends previous empirical evidence by suggesting a bifactor model as a possible solution to the controversy surrounding the factor structure (one- vs. two-factor model) of the EIS.

Although this bifactor model was preferred based on chi square difference testing, drawing on the principle of parsimony led us to believe that exercise identity is best represented as a unidimensional construct.

However, some limitations must be acknowledged. These concern the generalizability of the findings which could be increased by using more diverse samples and cross-validating the results regarding factor structure and measurement invariance in independent samples. Besides, whether our results regarding the factor structure can be extrapolated to the English scale is currently unclear. Finally, measurement invariance between exercisers and nonexercisers is yet to be demonstrated as it seems quite likely that exercisers and nonexercisers do not interpret the EIS items in a conceptually similar manner.

To conclude, the results of study 1 provide a validated instrument for assessing exercise identity in a German-speaking sample that can be used for investigating the research question derived above (see also chapter 3.3).

2.3   Study 2: Effects of exercise self-schema on reactions to self-relevant feedback

The aim of study 2 was to test the assumption that the elaborateness of the exercise-related self-aspect moderates whether affective and cognitive reactions to self-relevant feedback follow the predictions of self-enhancement or self-consistency theories (chapter 1.4). The elaborateness was captured by means of exercise self-schema.

2.3.1   Methods

A total of $N = 472$ German adults (53% female) between 17 and 71 years of age ($M = 31.4$ years, $SD = 11.9$) participated in the online experiment. In a cover story, participants were told that they were to take part in a study evaluating the subjective acceptance of a newly developed test measuring six aspects of exercise and health. During data collection, exercise self-schema was assessed first (Kendzierski, 1988; Kendzierski, Sheffield, & Morganstein, 2002). Afterwards, participants rated themselves in six aspects related to exercise and sports, namely physical fitness, sportiness, physical resilience, health, physical well-being, and physical attractiveness. Following the alleged test, which consisted of questionnaire items and two reaction tests (in the style of an implicit association test and an emotional Stroop test), participants were provided with bogus feedback that either mirrored their self-assessments (consistent feedback) or deviated positively or negatively from their own self-views. Each type of feedback was given randomly in two of the six aspects. After presentation of each feedback, affective reaction (spontaneous emotion, satisfaction) and cognitive reaction (accuracy of the feedback, agreement of assessments by well-acquainted others with the feedback) were assessed with two items each. The two items were averaged and then averages were computed across the two corresponding conditions to result in one affective and one cognitive reaction score for each condition (consistent, positive, negative). A manipulation check was included, and a full debriefing followed. Hypotheses testing was done separately for affective and cognitive reaction by means of 2 (between-subject factor exercise self-schema: yes vs. no) x 3 (within-subject factor type of feedback: negative vs. consistent vs. positive) analyses of variance.

2.3.2 Results

Fifty-six percent of the sample were classified as being schematic for exercise. The manipulation check proved successful: Participants perceived positive feedback to be better than expected, negative feedback to be worse than expected and consistent feedback to meet their expectations.

For *affective reaction*, the analysis showed a significant main effect of type of feedback, $\eta_p^2 = .67$: Regardless of exercise self-schema, participants felt better after receiving positive compared to consistent feedback, and after receiving consistent compared to negative feedback. Besides, we found a significant interaction between exercise self-schema and type of feedback, albeit with a rather small effect size, $\eta_p^2 = .02$ (see left side of figure 2.1). Further probing of this result using contrasts yielded no interaction for the hypothesized comparison of reactions to consistent and positive feedback, suggesting that affective reactions to positive and consistent feedback are not moderated by exercise self-schema. The aforementioned interaction can be ascribed to a moderating effect of exercise self-schema with regard to consistent compared to negative feedback, $\eta_p^2 = .04$: This ordinal interaction indicates that individuals schematic for exercise react more positively to consistent as compared to negative feedback than individuals without exercise self-schema.
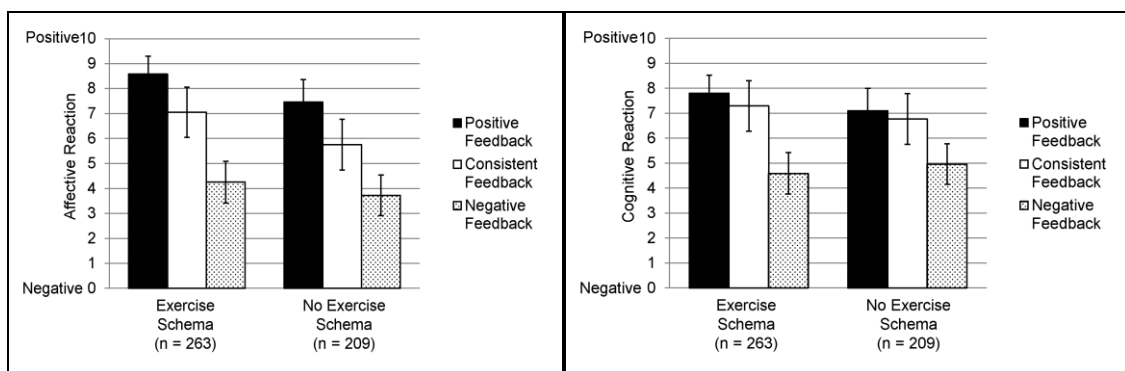
Figure 2.1:   *Effect of exercise self-schema and type of feedback on affective (left) and cognitive (right) reaction. Pictured are means and standard deviations (N = 472).*

For *cognitive reaction*, similar results were found: A significant main effect suggests participants felt that positive feedback was a more accurate assessment of them than consistent feedback, and consistent feedback was perceived as being more accurate than negative feedback, $\eta_p^2 = .47$. A significant interaction effect between exercise self-

schema and type of feedback was found, $\eta_p^2 = .04$ (see right side of figure 2.1). Breaking down this interaction using contrasts showed that the hypothesized interaction between exercise self-schema and consistent compared to positive feedback could not be confirmed. Instead, individuals with and without exercise self-schema differed in their reaction to consistent as opposed to negative feedback: Just like for affective reaction, the mean difference between cognitive reaction to consistent and negative feedback was smaller for individuals without exercise self-schema than for exercise schematics.

2.3.3 Discussion

The hypothesized moderating role of exercise self-schema when processing positive as opposed to consistent feedback could not be confirmed in this study. Both affectively and cognitively, participants preferred feedback deviating positively from their self-assessments as opposed to consistent feedback, which is in line with the predictions of self-enhancement theories. While no hypothesis was formulated regarding the interaction of exercise self-schema and reactions to negative as opposed to consistent feedback, individuals schematic for exercise devalued negative feedback more in comparison to consistent feedback. This was true for both affective and cognitive reaction. Theoretical implications of these results are discussed in chapter 3.1.

On a methodological level, some limitations must be acknowledged: (1) Exercise self-schema was used as a means of operationalizing the elaborateness of the exercise-related self-aspect. While this is in line with the theoretical notions of the integrative self-schema model (chapter 1.2.4.2), it poses some methodological challenges: The classification of participants into the four categories proposed by Kendzierski (1988) has proven problematic, which is why we only used two categories. Besides, the approach assumes that individuals either "have" an exercise self-schema or they don't. However, it might be useful to be able to analyze elaborateness more precisely by using a continuous measure that allows for a wider range of values defining the self-as-exerciser (Berry et al., 2014). (2) We assessed exercise self-schema, and provided feedback in a number of domains that we assumed to be closely related to exercise. However, it is possible that individuals perceived these domains' connection to their self-as-exerciser as being more or less pronounced (e.g., physical fitness having a stronger con-

nection to the self-as-exerciser than health)[10]. (3) The dependent variables were assessed by only two items each. While this is consistent with most of the studies testing the integrative self-schema model, making use of more standardized forms of questionnaires could prove fruitful in order to enhance reliability. (4) Finally, the exercise feedback was generated from an alleged test conducted online. Even though the manipulation check showed that the bogus feedback was perceived as intended, it is quite possible that exercise-related feedback based on "real-world" data, such as physiological measures, would enhance the personal importance and credibility of the feedback. We tried to address these limitations in study 3.

2.4 Study 3: Does exercise identity moderate affective and cognitive reactions to feedback on physical fitness?

The aim of study 3 was to retest the central hypotheses of the present dissertation. In doing so, the limitations of study 2 were addressed by (1) using exercise identity (chapter 1.3.2) as a means of operationalizing the elaborateness of the exercise-related self-aspect, (2) conducting the study in a laboratory setting (allegedly) using participants' physiological data to generate the bogus feedback, (3) providing feedback in a domain that is assumed to be directly connected and central to the self-definition as an exerciser (physical fitness), and (4) increasing the reliability of the dependent variables.

2.4.1 Methods

The main idea of the study was comparable to that of study 2. A total of $N = 215$ university students (64% male; $M_{age} = 23.8$ years, $SD = 2.3$; 83% classified themselves as regular exercisers; students of sports sciences and kinesiology were excluded) expected to take part in a study investigating the subjective acceptance of a physical fitness test without needing to exert themselves physically (cover story).

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[10] A pilot study was conducted to address the question of whether the domains used in study 2 were perceived as being more strongly connected to the attributes characterizing the exercise self-schema than six control domains (musicality, intelligence, language competency, emotionality, spontaneity, willingness to compromise). Based on the ratings (scale: 1–6) of N = 399 participants (56% female; age: M = 31.65 years, SD = 12.18), the domains used in this study were judged as being far more connected to being an exerciser, $4.77 \leq M \leq 5.61$, than the control domains, $2.12 \leq M \leq 3.13$, which was confirmed with a multivariate analysis of variance contrasting the domains used in the study and the control domains, F(1, 398) = 2487.33, p < .001, ηp² = .86. However, a repeated measures analysis of variance and post-hoc pairwise comparisons suggest that not all six domains in which feedback was given were connected in the same way to the attributes describing the self-as-exerciser, F(5, 1990) = 54.57, p < .001, ηp² = .121.

After exercise identity was assessed with the measure described in study 1, participants rated their own physical fitness. The alleged FitnessIndex test used the OwnIndex function implemented in some Polar heart rate watches. It estimates VO_2max from heart rate and heart rate reliability in a resting position. Participants were randomly assigned to one of three feedback conditions (negative, consistent, positive), and feedback presented after the alleged test was again based on their previous self-assessment only. Affective reaction to the feedback was measured using nine items derived from Weiner's (1985) theory of achievement attribution and emotion (e.g., How happy are you with the result?). Negative emotions were reverse-coded so that higher values indicate more positive affect. To assess cognitive reaction, we used nine items adopted from Swann et al. (1987) as well as Woo and Mix (1997) that dealt with the accuracy of the (alleged) test result (e.g., How accurate do you think this result is?) and the diagnosticity of the fitness test (e.g., How well do you think this test measures physical fitness?). A manipulation check was included. Afterwards, the participants were fully debriefed about the purpose of the study, its variables, and the contrived nature of the feedback.

Hypotheses testing was done separately for affective and cognitive reaction by means of moderated regression analyses with a multicategorical predictor (Hayes & Montoya, 2017). Type of feedback was dummy coded using consistent feedback as the reference category.

2.4.2 Results

The manipulation check showed that participants in the positive feedback condition judged their test result to be better, and participants in the negative feedback condition to be worse than expected, whereas individuals in the consistent feedback condition stated their result met their expectations.

For *affective reaction*, regression analyses indicated that exercise identity did not moderate affective reaction to different types of feedback, with both interaction variables being nonsignificant and the addition of the interaction terms not leading to a significant increase in explained variance, $\Delta R^2 = .006$ (see left side of figure 2.2). Type of feedback predicted affective reaction: Participants displayed significantly more positive affect in response to positive as opposed to consistent feedback, and less positive affect in response to negative as opposed to consistent feedback.
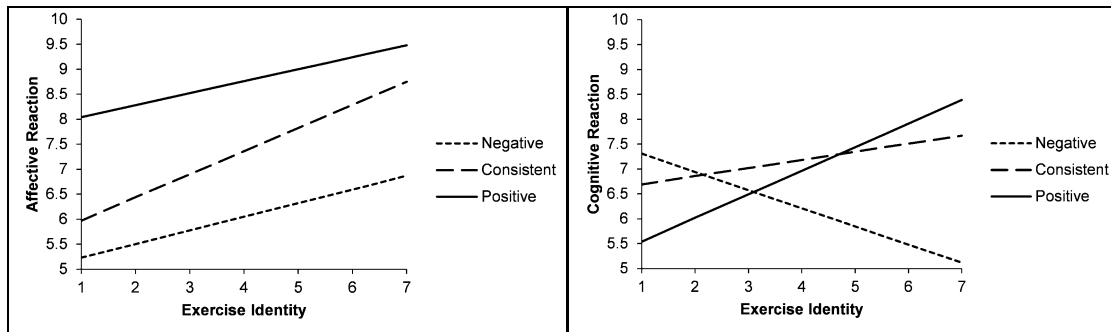
Figure 2.2:   *Effect of exercise identity and type of feedback on affective (left) and cognitive (right) reaction (N = 472).*

For *cognitive reaction*, including both interaction terms in the model led to a significant increase in explained variance, $\Delta R^2 = .149$, and both interaction terms were significant, indicating that exercise identity moderates both the interaction between positive and consistent and the interaction between negative and consistent feedback (see right side of figure 2.2). Further probing of the hypothesized interaction between consistent and positive feedback yielded a significantly more positive cognitive reaction to consistent feedback as opposed to positive feedback for individuals very low in exercise identity, which is contrary to the hypothesized effect. For the interaction between consistent and negative feedback, we found no difference between reactions to consistent and negative feedback for individuals low in exercise identity; but for individuals high in exercise identity, the cognitive reaction to negative feedback was significantly less positive than the one to consistent feedback.

2.4.3 Discussion

Affective reaction was not moderated by exercise identity strength. Instead, self-enhancement strivings related to the affective nature of the reaction (Kwang & Swann, 2010; Shrauger, 1975) seem to override any effects pertinent to the elaborateness of the exercise-related self-aspect.

Exercise identity moderated cognitive reaction to different types of feedback. However, for the hypothesized interaction between consistent and positive feedback, we found a pattern contrary to the one expected: Individuals very low in exercise identity welcomed consistent feedback more than positive feedback, whereas for all other participants, no difference in reaction to positive and consistent feedback was found. Furthermore, for the comparison of consistent and negative feedback, cognitive reaction to negative

feedback got more negative with stronger exercise identity, whereas consistent feedback was perceived more positively as exercise identity strength increased. The original hypotheses could therefore not be confirmed, suggesting a general dominance of the self-enhancement principle in the sport and exercise domain. Implications of these results are discussed together with the results of study 2 in more detail in chapter 3.1, and limitations are addressed in chapter 3.2.

3   General Discussion

The aim of the present dissertation was to test the moderating role of the elaborateness of the exercise-related self-aspect on the processing of self-relevant feedback. Consequently, I tested whether self-relevant information is processed according to the predictions of self-enhancement (i.e., preference for positive compared to consistent feedback) or self-consistency theories (i.e., preference for consistent compared to positive feedback), depending on the elaborateness of the exercise-related self-aspect. In particular, I distinguished between affective and cognitive reaction and provided self-relevant feedback that either matched participants' self-assessments (consistent feedback condition) or deviated positively from their self-assessment. Besides, a negative feedback condition was included as well.

It was hypothesized that for affective reaction, individuals with a less elaborated self-as-exerciser would prefer positive as opposed to consistent feedback, whereas for individuals high in elaborateness, no difference in reaction to positive and consistent feedback was assumed (due to the simultaneous impact of affective reaction favoring self-enhancement and high elaborateness favoring self-consistency). For cognitive reaction, individuals with highly elaborated exercise-related self-aspects were supposed to prefer consistent over positive feedback, whereas for individuals who identified less with being an exerciser, no preference for either kind of feedback was expected (due to the simultaneous impact of cognitive reaction favoring self-consistency and low elaborateness favoring self-enhancement).

The elaborateness of the exercise-related self-aspect was assessed by means of exercise self-schema (study 2) and exercise identity (study 3). As no validated instrument assessing exercise identity exists in German language, a secondary aim of the present dissertation was to provide a psychometrically sound and validated German translation of the EIS (Anderson & Cychosz, 1994). Apart from the sheer translation, it was also an objective to add to the literature by examining the factor structure of the EIS, as it is currently unclear whether exercise identity is best represented as a one- or a two-dimensional construct.

In the present chapter, I will first discuss theoretical implications of the results of study 2 and study 3 (chapter 3.1). Afterwards, some limitations of these studies are

acknowledged (chapter 3.2). Finally, a conclusion and suggestions for further research are provided, which include a discussion of the results of study 1 (chapter 3.3).

3.1   The moderating role of exercise self-schema and exercise identity on the processing of self-relevant feedback

Results of study 2 and study 3 did not support the hypothesized moderating role of the elaborateness of the exercise-related self-aspect.

For *affective reaction*, both studies found that individuals reacted more positively to positive as opposed to consistent feedback, thus suggesting a dominance of the self-enhancement principle. It seems that the affective nature of the reaction triggers self-enhancement strivings overriding any effects pertinent to the elaborateness of the exercise-related self-aspect.

For *cognitive reaction*, a significant interaction between type of feedback (consistent vs. positive) and elaborateness of the self-as-exerciser was found in study 3 only, and this interaction was contrary to the hypothesis: Individuals who did not identify with being an exerciser at all actually judged accuracy and diagnosticity of consistent feedback to be higher than that of feedback deviating positively from their self-assessment. For all other levels of exercise identity, no difference between reactions to consistent and positive feedback was found.

The unexpected result of study 3 could indeed be explained when one considers what Markus (1977) and Kendzierksi (1988) called nonexerciser schematics (see also the idea of sedentary behavior identities/schemas, Rhodes et al., 2016). These are individuals who do possess an elaborated exercise-related self-aspect, but in the opposite direction, i.e., they are schematic for *not* being an exerciser (chapter 1.3.1.1). This "nonexerciser identity" is therefore assumed to be stable and quite resistant to change and could explain why positive feedback was rejected in comparison to consistent feedback. The fact that this pattern was only found in study 3 and not in study 2 could then be explained by the fact that in study 2, nonexerciser schematics were not analyzed separately but combined with aschematics and unclassified participants. The assumption that the elaborateness of the exercise-related self-aspect actually did moderate information processing, but only in individuals who hold a strong belief about *not* being an exerciser therefore needs replication.

An alternative explanation is also possible: The integrative self-schema model assumes that individuals with less elaborated self-aspects prefer positive feedback because they see it as a chance to self-enhance (chapter 1.2.4.2). However, in the case of individuals who don't identify with being an exerciser, it is quite likely that their self-assessments were rather low and, in turn, positive feedback was in fact more positive than their self-assessment, but possibly still not seen as favorable feedback. For example, in study 3, an individual who judged their physical fitness to be better than that of 5% of people their sex and age would have been told that in fact, their physical fitness was better than that of 28% of people their sex and age in the positive feedback condition. While this feedback is better than expected, it might still not be something to be proud of.

Parallel to research on the integrative self-schema model, *feedback that deviated negatively* from the participants' self-assessments was included as well, but no specific hypotheses were formulated for this feedback. Both study 2 and study 3 found that for cognitive reaction, an interaction between the elaborateness of the exercise-related self-aspect and reactions to consistent as opposed to negative feedback emerged. In both studies, individuals who identified strongly with being an exerciser devalued negative feedback a lot more compared to consistent feedback, whereas for individuals low in exercise identity or without exercise self-schema, respectively, cognitive reaction to negative and consistent feedback was closer. The same pattern was found for affective reaction in study 2. It is therefore quite possible that the elaborateness of the self-as-exerciser does indeed moderate information processing, but that this is not displayed in different reactions to consistent as opposed to positive feedback—as formulated in the integrative self-schema model (chapter 1.2.4.2)—but in different reactions to consistent as opposed to negative feedback. However, what this means in terms of self-consistency or self-enhancement strivings is not entirely clear. The rejection of negative feedback has mainly been discussed as a strategy related to self-enhancement (e.g., Crocker & Park, 2004). More recently, some authors have suggested to treat self-enhancement and self-protection separately, i.e., self-enhancement is concerned with self-advancement and increasing the positivity of one's self-view, whereas self-protection is concerned with self-threat (e.g., Alicke & Sedikides, 2009; Elliot & Mapes, 2005; Sedikides 2012; Sedikides & Gregg, 2008). The negative feedback provided in study 2 and study 3 can be understood in terms of threatening the self and thus it seems that self-protection is

actually the motive that is influenced most by the elaborateness of the exercise-related self-aspect. Individuals who identify strongly with being an exerciser seem to defend themselves against negative feedback a lot more than individuals who see exercise as a less central part of their self. This is in line with other research showing that self-protective mechanisms seem to be more pronounced for aspects central to the self (Green, Pinter, & Sedikides, 2005). Further studies should therefore place an emphasis on examining the processing of negative feedback in sport and exercise situations.

The results of study 2 and study 3 contradict the results of previous studies that found the elaborateness of specific self-aspects to moderate reactions to positive as opposed to consistent feedback (e.g., Burke & Reitzes, 1991; Dauenheimer et al., 1999; Korsgaard, 1996; Petersen, 1994; Petersen et al., 2000a, 2000b, see also chapter 1.2.4.2). These studies provide support in particular for the assumption that in highly elaborated self-aspects, individuals react more positively to consistent feedback, both affectively and cognitively. One possible explanation is that in most of these studies—especially the ones investigating the integrative self-schema model—feedback was provided in domains related to personality (e.g., masculinity, spontaneity, extraversion). It seems plausible that these are domains in which an optimum, rather than a maximum value is desirable for most people. For example, most individuals would agree that it is neither helpful to be a person as spontaneous as possible nor a person who is not spontaneous at all (i.e., the desired feedback would be somewhere in between). However, the feedback I provided concerned domains more or less related to performance—physical fitness in both studies, as well as sportiness, physical resilience, health, physical well-being, and physical attractiveness in study 2. It seems plausible to assume that these are domains in which most people would agree it is desirable to receive feedback as positive as possible. It is therefore feasible to expect a general dominance of the self-enhancement motive in domains related to performance that could override any effect pertinent to the elaborateness of the self-aspect in question. A second possible argument for this reasoning concerns the fact that feedback based on objective criteria (e.g., the heart rate assessment used in study 3, and to a certain extent also the reaction tests included in study 2) is much less easy to change—at least as long as self-presentation is concerned. Personality feedback based on responses to questionnaire items can be altered rather easily and so favorable feedback can be achieved much easier "if needed" than is the case for

performance feedback (Dauenheimer et al., 1997). In the case of physical fitness feedback, it is also possible that physical fitness might be perceived as genetically determined by some people, thus seeing it as something out of personal control. An assumed difference of the type of domain in which feedback is provided (personality vs. performance/abilities) would also explain why Anseel and Lievens (2006) could not replicate the assumptions of the integrative self-schema model in an organizational context. They provided feedback on general managerial competencies that was based not only on questionnaire items, but also on performance tasks.

Another aspect worth discussing is the role of initial self-assessment. Stahlberg et al. (1999) discuss that when initial self-assessment is high, consistent feedback might as well be perceived as positive feedback because the self-assessment was also "positive" in the first place. A general problem in many studies investigating the interplay between self-enhancement and self-consistency strivings is that in many cases, no initial self-assessment or self-view measures are included in these studies (e.g., Sedikides, 1993), leading Kwang and Swann (2010) to state that many studies providing evidence for self-enhancement strivings may in fact reflect self-verification strivings, because "in unselected samples roughly 70% will possess positive self-views" (p. 275). Interestingly, for the present dissertation, self-assessments were higher in the online study (the lowest mean being $M = 66.9$ out of 100 points, $SD = 25.2$, for physical fitness) than in the laboratory study ($M = 53.3\%$ better than the average person, $SD = 10.1$), suggesting that the setting may play a role for self-assessment.

Besides, in most studies examining self-enhancement and self-consistency strivings, no real "consistent" feedback condition is included, but the type of feedback provided is either positive or negative, and more often than not the same positive and negative feedback for the whole sample is used (e.g., Baumeister & Tice, 1985; McFarland & Ross, 1982; Swann et al., 1987). In general, when self-enhancement and self-consistency (self-verification) theory are discussed together (e.g., Kwang & Swann, 2010; Swann et al., 1987), it is always pointed out that they make the same predictions for individuals with positive self-views (a preference for positive over negative feedback), but differ in their predictions for individuals with negative self-views (a preference for negative feedback in self-consistency theory, and a preference for positive feedback in self-enhancement theory). It therefore seems that self-assessments are seen as either positive

or negative, the role of "neutral" self-assessments is barely addressed. This renders the results of the present dissertation difficult to compare with many studies conducted in social psychology. In study 2 and study 3—paralleling the general study design used in studies investigating the integrative self-schema model—consistent feedback meant feedback that confirmed one's self-view, regardless of whether this self-view was negative, neutral, or positive. This consistent feedback could therefore be perceived as either negative, neutral or positive, depending on initial self-view. Likewise, positive feedback did not generally mean that the feedback was positive per se (in terms of an absolute standard, e.g., above average), just that it was more positive than the participant expected. For example, in study 2, an individual who judged his physical resilience to be rather low (e.g., 8 out of 100 points) would have been told he scored 31 out of 100 points in the positive feedback condition. While this represents a positive feedback in that it exceeds the individuals' expectations, it does not necessary equal positive feedback in absolute terms, as the score is still well below the midpoint of the scale. The same line of thinking goes for negative feedback as well—for individuals who judged themselves to be very healthy, for example, negative feedback was lower than they expected, but it might still have been well above the midpoint of the scale and therefore not perceived as being completely negative.

While the approach taken in study 2 and study 3 (i.e., a "real" consistency condition is included and feedback is based on self-assessments) has some advantages over previous studies, it also entails two problems: First, it is unclear whether "positive" feedback (compared to one's initial self-assessment) means the same for someone who has a highly positive self-view anyway than it means for someone who has a highly negative self-view. The perception of the different feedback conditions could therefore be confounded with the participants' initial self-assessment. Second, as it is quite logical to assume that individuals who strongly identify with being an exerciser also assess their physical fitness higher than individuals who identify less strongly with the role of an exerciser (in study 3, the correlation between exercise identity strength and self-assessment was $r = .60$), initial self-assessments are confounded with the moderator variable. While exercise self-schema/exercise identity did not interact with the manipulation check in both studies, i.e., regardless of schema/identity strength, individuals judged negative feedback to be more negative than expected, consistent feedback to be

as expected, and positive feedback to be more positive than expected, the role of initial self-assessment certainly warrants further investigation.

All in all, study 2 and study 3 yielded rather similar results. This is despite the fact that both studies differed in several important aspects:

- the operationalization of the elaborateness of the exercise-related self-aspect (exercise self-schema in study 2, exercise identity in study 3),
- the operationalization of the dependent variables (two items for affective and cognitive reaction each in study 2, nine items each in study 3),
- the setting (online in study 2, laboratory in study 3),
- the nature of the feedback (allegedly based on questionnaire items and reaction tests in study 2, based on physiological data in study 3),
- the framing of both the social comparison and the feedback (absolute point values in study 2, social comparison framing in study 3),
- the relation between the exercise-related self-aspect and the feedback domains (six domains which differed in how closely they were connected to the self-as-exerciser in study 2, one domain assumed to be central and directly linked to the self-as-exerciser in study 3),
- the number of pieces of feedback provided (intraindividual feedback in study 2, interindividual feedback in study 3),
- the participants (no population-related exclusion criteria in study 2, only university students in study 3).

In spite of these differences, study 3 can be considered a conceptual replication of study 2. Taken together, the results thus suggest a general dominance of the self-enhancement (and the self-protection, respectively) motive in the sport and exercise domain over the self-consistency motive. As the results show very similar patterns, it seems that the observed effects are independent of the points raised above.

In particular, the results imply that operationalizing the elaborateness of the self-as-exerciser as exercise self-schema or exercise identity is relatively negligible when the processing of self-relevant information is concerned. This confirms the conclusions of Berry et al. (2014) and Rhodes et al. (2016) who investigated the relation of these constructs in terms of their relation to exercise behavior. For future research, it might be feasible to concentrate on the exercise identity construct as categorization of partici-

pants according to the Exerciser Self-Schema Scale (Kendzierski, 1988) typically leads to small sample sizes for aschematics and nonexerciser schematics, and large parts of the sample remain unclassified (chapter 1.3.1.1). The continuous scores resulting from the use of the EIS might therefore provide the range needed to further examine the interplay between the self-as-exerciser and affective, cognitive, and behavioral constructs.

3.2   Limitations

The results discussed above must be seen in the light of some limitations. First, although the sample in study 2 was quite diverse, the generalizability of the findings can be questioned. For example, in both study 2 and study 3, highly educated participants were overrepresented. This means that I cannot be sure whether the results transfer to other populations. It could be especially interesting to examine if the processing of physical fitness feedback differs by age, as fitness and subsequently the satisfaction with one's health decreases with age (e.g., Cheng, 2004). It has been shown that individuals with more positive self-perceptions of aging tend to engage more in preventive health behaviors, including exercise (Levy & Myers, 2004). Besides, social comparison processes seem to be more important for older than for younger people (Cheng, Fung, & Chan, 2007). It seems plausible to assume that the processing of exercise-related feedback differs as a function of age.

Second, the manipulation of the feedback by means of a 23 difference to initial self-assessment was based on a pilot study by Stahlberg et al. (1999). The authors found that this difference was perceived as capturing feedback that differed from one's own self-rating best. I did not test directly whether the same difference was the optimal difference for feedback in the sport and exercise domain, although the manipulation check suggests so. However, whether a larger or smaller deviation from the self-assessment would yield different results is currently unclear.

Third, the self-related feedback in study 2 was based on an (alleged) online test, and feedback in study 3 on a test allegedly derived from resting heart rate (variability). Considering the fact that the sport and exercise domain is highly physical, a further limitation could concern the nature of the alleged tests used. The credibility and perceived importance of the feedback would well be enhanced if it was based on a "real" fitness test involving physical exertion. However, it seems quite challenging to create a fitness

test that can be realized by both exercisers and nonexercisers and is able to deliver feedback that is non-objectively verifiable.

Fourth, although the measurement of the dependent variables can be seen as an improvement from study 2 to study 3, they offer only a limited range of information concerning the reactions to exercise-related feedback. For example, for affective reaction, it could be fruitful to study positive and negative affect separately (Ilies, De Pater, & Judge, 2007). For cognitive reaction, I examined accuracy and diagnosticity of the feedback only. However, cognitive reaction also includes other variables, for example attentional and attributional processes, overclaiming bias (e.g., Paulhus, Harms, Bruce, & Lysy, 2003), or recall accuracy. In organizational psychology, various scales to assess feedback reactions have been developed (e.g., a 28-item multidimensional scale by Kedharnath, Garrison, & Gibbons, 2009 with subscales such as accuracy, specificity, fairness, and intent to use; or a short 5-item scale by Anseel, Van Yperen, Janssen, & Duyck, 2011) that could be adapted to meet the demands of sport and exercise psychology. Furthermore, of special relevance for the field of sport and exercise are behavioral reactions that I did not assess at all. For example, Renner (2004) showed that although individuals receiving negative feedback concerning their cholesterol levels cognitively reacted more negatively to the test result than participants receiving positive feedback, they were also more inclined to change their behavior in a favorable direction. Petersen et al. (1996) also found that participants were more interested in further information concerning negative than consistent or positive feedback, a fact they explained by a dominance of the self-assessment motive. Whether (recurring) feedback—especially negative feedback—leads to changes in exercise behavior (e.g., starting or leaving exercise) would be an interesting topic to investigate in terms of exercise promotion and adherence but also in terms of dropout in elite sports. Maybe the function of negative feedback also differs with stage of exercise adoption: It is possible that negative feedback leads to taking up exercise, but it is also possible that negative feedback in the phase of action may lead to early dropout.

Fifth, whether exercise self-schema and exercise identity truly capture the elaborateness of the exercise-related self-aspect has not yet been examined directly. Petersen and colleagues (2000a) provide indirect evidence that individuals judge schematic self-aspects to be more connected to other attributes and state that these self-aspects would be more

difficult to change in comparison to aschematic self-aspects. Although the structural organization of the self described in chapters 1.1.3.2 and 1.1.3.3 can mostly be seen as a consensus among self and identity researchers now, more direct empirical evidence for the connectionist and neural network analogy model has yet to be provided. Currently, measures that assess whether a self-view is held with high extremity, centrality, or certainty are the easiest "workaround" solutions available. However, it should be pointed out that there is no consensus on whether extremity, certainty, and importance ratings should all be included when capturing the elaborateness of self-aspects and it is unclear how these characteristics are associated. In study 2, extremity and importance were assessed by means of the Exerciser Self-Schema Scale (Kendzierski, 1988). In study 3, the EIS (Anderson & Cychosz, 1994) taps into both extremity and importance as well, although these aspects are assessed more indirectly (e.g., "I would feel a real loss if I were forced to give up exercising" or "I need to exercise to feel good about myself" implies a high personal importance). Certainty (or self-concept clarity, Campbell, 1990) was not assessed in the present studies, however, it seems plausible that exercise schematics, or individuals who identify strongly with being an exerciser, will also hold their self-views with higher certainty (Mullen, 2011). To what extent extremity/positivity, centrality, and certainty are independent characteristics of self-views and whether these attributes influence information processing differently has been subject of debate for several years already[11]. For example, Green et al. (2005) state that "central self-conceptions are very positive and descriptive, held with high certainty, and considered important" (p. 226), considering positivity, descriptiveness, certainty, and importance as characteristics of centrality. Pelham (1991) on the other hand found that certainty is more related to cognitive factors, whereas importance is more closely linked to emotional and motivational factors. In general, he found that individuals preferred consistent feedback when they were very certain of their self-assessments, and that they preferred positive feedback when they were less certain, which is in line with the moderating role of the elaborateness discussed in chapter 1.2.4.2. Other studies showed the same (e.g., Dutton, 1972; Pelham & Swann, 1994; Swann, 1990; Swann & Ely, 1984). For importance ratings, the effect is less clear. Some authors argue that in aspects central to the

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[11] For a similar discussion regarding attitudes see Krosnick, Boninger, Chuang, Berent, & Carnot (1993). As the self is sometimes seen as the attitude toward oneself by some authors (e.g, Rosenberg, Schooler, Schoenbach, & Rosenberg, 1995), this debate can be directly transferred to research on self and identity.

self, the self-enhancement motive should be more pronounced (e.g., Crocker, 2002; Crocker & Wolfe, 2001; Jones, 1973; Sedikides, Gaertner, & Toguchi, 2003; Thomas, 1989). Others assume that for central self-aspects, the self-verification motive should dominate information processing (e.g., Swann, 1990). The problem is that extremity and importance ratings are often highly correlated, i.e., self-aspects deemed to be important are often the same self-aspects that (at least healthy) individuals rate to be rather positive. This could explain why Burke, Kraut, and Dworkin (1984) as well as Nystedt, Smari, and Boman (1991) found that self-schema measures including importance ratings lacked incremental validity in comparison to measures including extremity ratings only. On the other hand, in the exercise context, Sheeran and Orbell (2000) found that it was the importance rating of the Exerciser Self-Schema Scale (and not the self-descriptiveness rating) that moderated the intention-behavior-gap in exercise. The interplay between extremity/positivity, certainty, and importance ratings in assessing the elaborateness of the exercise-related self-aspect therefore warrants future investigation. Finally, in the present dissertation, only type of feedback (affective vs. cognitive) and the elaborateness of the exercise-related self-aspect were considered in terms of moderating whether information is processed according to self-enhancement or self-consistency principles. However, other variables are discussed in the literature that could moderate whether people prefer consistent or positive feedback. These include (but are not limited to)

- the motivation to change one's self-views (e.g., Dauenheimer, 1996; Green, Sedikides, Pinter, & Van Tongeren, 2009): If motivation to change is high, a dominance of the self-enhancement motive is assumed.

- regulatory focus (Förster, Grant, Idson, & Higgins, 2001): If people display a promotion focus (i.e., they value advancement and accomplishment), they react more sensitively to positive feedback (praise) than to negative feedback (criticism).

- achievement motivation (Anseel et al., 2011): Individuals pursuing performance-approach goals reacted more negatively to comparative feedback relative to individuals pursuing mastery-approach goals.

- capability of introspection (Hixon & Swann, 2003): Self-verification has been shown to be more likely when individuals have a higher capability to introspect.

- commitment to the source of self-evaluation (Swann, De La Ronde, & Hixon, 1994): When individuals are particularly committed to the source of self-evaluation, the preference for consistent feedback is more pronounced.

Most existing studies that examine whether self-enhancement and self-consistency occur under different circumstances have only considered one or two of the moderator variables discussed above. However, understanding the dynamic interplay between the mechanisms that are responsible for self-enhancement or self-consistency to emerge is critical, and therefore several moderator variables must be investigated simultaneously. Besides, basically all psychological phenomena are multiply determined (Alicke & Sedikides, 2009). Apart from self-enhancement and self-consistency, other self-evaluations are discussed (e.g., self-assessment, self-improvement, see for example Sedikides & Strube, 1997) that could influence information processing.

3.3 Contributions and implications for further research

In chapter 1, I explained that structural aspects of the self—and especially the influence of these aspects on information processing—have barely been addressed in sport and exercise psychology until now. Study 2 and study 3 of the present dissertation therefore expand previous research by being the first to examine the moderating role of exercise self-schema/exercise identity on the preference for consistent as opposed to positive exercise- and self-relevant feedback. How individuals process feedback is an important factor in both exercise and (elite) sports. The studies suggest that individuals feel more positive affect after receiving positive feedback (affective reaction), and that they also tend to judge positive feedback as more accurate and diagnostic than consistent feedback (cognitive reaction), regardless of whether they identify strongly with being an exerciser or not. However, what this means in terms of subsequent behavior and also in terms of self-representations (i.e., how is recurring consistent or positive feedback integrated into exercise-related self-views) is currently unclear.

Until now, feedback research in the sport and exercise domain has focused on technical feedback, e.g., mode (visual/verbal), timing, frequency (e.g., Goh, Kantak, & Sullivan, 2012; Schmidt & Lee, 2011), or on the effect of feedback on intrinsic motivation and performance (e.g., Àvila et al., 2012; De Muynck et al., 2017; Mouratidis et al., 2008; Whitehead & Corbin, 1991). What actually happens in terms of information processing (in particular with regard to individuals' existing self-views) when individuals receive

feedback has been given little attention. This is all the more surprising given that in order to act on the feedback, a prerequisite is that individuals are willing to accept and respond to the feedback (Ilgen et al., 1979; Kinicki et al., 2004). It could therefore be worthwhile to transfer existing literature on the processing of self-relevant feedback from organizational psychology (e.g., Anseel & Lievens, 2006, 2009; Anseel et al., 2011; Bell & Arthur, 2008; Garrison, 2014; Jussim et al., 1992; Kinicki et al., 2004; Korsgaard, 1996) into sport and exercise psychology. For example, Anseel and Lievens (2009) showed that feedback acceptance mediated attitudes towards the organization. Similar moderating or mediating functions of feedback processing are feasible in the sport and exercise domain as well. In particular, the role of negative feedback should be given special consideration, as it seems that self-views interact with the processing of negative feedback. From an applied perspective, the question is how coaches, instructors, or PE teachers, respectively, can provide feedback they know differs from their athletes' or students' self-assessments without the athletes or students defensively rejecting the feedback.

Study 2 and study 3 of this dissertation also contribute to the literature outside of sport and exercise psychology, namely self and identity research. It seems that the integrative self-schema model developed in the 1990s (e.g., Dauenheimer, 1996; Petersen, 1994) is not valid for all self-related domains. Probably, information processing in domains related to performance differs from domains related to personality traits. While the original authors acknowledge this fact as well (Dauenheimer et al., 1997), a study that investigates feedback reactions in performance-related and non-performance-related domains simultaneously has yet to be conducted. As not all studies investigating the integrative self-schema model found clear-cut support for the original hypotheses and subsequent research failed to support the predictions (e.g., Anseel & Lievens, 2006), future studies should be preregistered in light of the recent replication crisis in the social sciences and especially in psychology (e.g., Open Science Collaboration, 2012; Pashler & Wagenmakers, 2012; Simmons, Nelson, & Simonsohn, 2011; for sport and exercise psychology see Geukes, Schönbrodt, Utesch, Geukes, & Back, 2016; Schweizer & Furley, 2016).

I also want to discuss some implications and contributions of study 1. This study resulted in a successful translation of the EIS (Anderson & Cychosz, 1994) into German and

beyond that, adds to the literature by suggesting a bifactor structure in order to resolve the controversy regarding the dimensionality (one vs. two factors) of the scale. The results of study 1 show that the scale is treated best as representing a unidimensional underlying construct. Development of the EIS has been largely atheoretical (Sabiston et al., 2012), and if multidimensionality of exercise identity is proposed, it could be worthwhile to develop a scale assessing exercise identity by drawing on the tenets of identity theory (e.g., Burke & Stets, 2009) and on relevant literature in the exercise domain (e.g., model of self-definition by Kendzierski & Morganstein, 2009). On the other hand, treating exercise identity as a unidimensional construct has proven to be promising to complement social cognitive or stage-based models of behavior within research on exercise adoption and adherence. At its core, what seems to be relevant for this construct is whether individuals understand the role of an exerciser (or "self-as-exerciser") as a unique, distinctive description central to their self. Also, the relation between exercise identity and athletic identity (e.g., Brewer et al., 1993) has barely been addressed (see Reifsteck et al., 2016, for a start).

The EIS seems to be quite robust across cultures, yielding comparable results for the English, Spanish, Greek, Chinese and German versions and would probably retain its psychometric properties if carefully translated into other languages (Weeks, Swerissen, & Belfrage, 2007). Cross-cultural research therefore becomes possible, a field that is identified by Leary and Tangney (2012) as a potential direction of where self and identity research might be going in the coming years. For instance, given that research on self and identity has consistently found differences between Western and Eastern cultures (i.e., independent and interdependent self-construals, see for example Downie, Koestner, Horberg, & Haga, 2006; Singelis, 1994; Utz, 2004), it could be interesting to investigate whether there are cultural differences between the levels of exercise identity, or whether different moderator or interaction effects are prevalent when examining the relation between exercise identity and exercise behavior.

Traditional approaches trying to increase exercise adherence have been greatly influenced by social cognitive and stage-based models but have only been moderately successful (Rhodes et al., 2016). They could be supplemented by the integration of constructs from self and identity research (namely exercise self-schema/identity construct) that have consistently been linked to a number of social cognitive and affective varia-

bles central to the regulation of exercise. However, in order to use the self-as-exerciser even more successfully as a means to enhance exercise adoption, it is crucial to first understand how exercise-related self-perceptions are developed and maintained. Only then interventions aimed at changing identities can be designed. At the moment, little is known about how exercise self-schema/identity is acquired (e.g., Rhodes et al., 2016; Strachan & Whaley, 2013). Although assumed to be quite stable, some studies suggest that exercise identity might exhibit some change over time (e.g., Carraro & Gaudreau, 2010; Cardinal & Cardinal, 1997; Hardcastle & Taylor, 2005).

In order to understand the interplay between the mechanisms that are critical for self-definitions to occur, more complex models must be developed that consider the aforementioned aspects of social cognitive and affective variables central to the regulation of exercise simultaneously. For example, Strachan et al. (2015) suggest that exercise self-efficacy could serve as a mediator between exercise identity and exercise behavior. Kendzierski and Morganstein (2009) found that perceived ability and perceived commitment directly influenced exercise self-definitions, whereas perceived wanting, perceived trying and enjoyment showed indirect effects. In a longitudinal study, Perras et al. (2016) have successfully integrated future-orientated (possible) selves into exercise identity research. They showed that exercise identity mediated the relationship between possible selves and exercise behavior. However, to understand how the self develops over time, experimental and longitudinal studies are warranted that consider variables like exercise self-efficacy, exercise enjoyment, possible selves, abilities and so on simultaneously. In a second step, it could also be fruitful to investigate interindividual differences in the formation of exercise identity (Berzonsky, 2004) and to investigate exercise self-schema/identity development over the lifespan.

Also, several researchers have suggested that it could be beneficial to integrate the tenets of self-determination theory into self and identity research in the sport and exercise domain, as both lines of research deal with the self-regulation of behavior and attempt to explain exercise adherence (e.g., Strachan et al., 2013; Strachan & Whaley, 2013; Vlachopoulos et al., 2011; see also Jussim et al., 1992, for an integration outside of the sport and exercise domain). Ryan and Deci (2012) argue that identities function to serve the basic psychological needs of relatedness, competence, and autonomy. They also discuss the concept of internalization or integration of identities, arguing that identities

"vary in the extent to which they are actually assimilated to the self of the individual and therefore receive the person's full endorsement and volitional engagement" (p. 228). The continuum from amotivation to intrinsic motivation has also been adopted in sport and exercise psychology (see e.g., Seelig & Fuchs, 2006, for a German questionnaire), and the more self-determined regulations postulated in self-determination theory have been shown to be related to exercise identity (Reifsteck et al., 2016; Strachan et al., 2013; Vlachopoulos et al., 2011).

From an even broader perspective, research on self and identity in the next decades "will depend in large measure on how successfully broad theoretical advances are able to link together specific bodies of research that deal with self and identity" (Leary & Tangney, 2012, p. 15). At the moment, many self-related phenomena and processes are discussed separately from each other which in part is due to the fact that the self is involved in basically all psychological processes. Morf and Mischel (2012) add that it is crucial to cross disciplinary boundaries if a thorough understanding of self and identity is desired. Future directions in self and identity research include advances in neuroscience (i.e., how representations of the self develop in terms of biomechanical and electrical activity in the brain), advances in how self and identity (or specific self-aspects) emerge and develop over time, as well as cross-cultural research (Leary & Tangney, 2012).

Within sport and exercise psychology, one of the most investigated topics remains the effect of sport and exercise on self-esteem. Results are rather inconclusive, and the subsequent search for moderators has concentrated on variables concerning characteristics of sport and exercise (Hänsel, 2008; see also chapter 1.1.3.1). While the present dissertation did not directly investigate the association between exercise/sport and self-esteem, it provides a starting point insofar as the processing of self-relevant feedback in the sport and exercise domain as a function of the elaborateness of the self-as-exerciser could be used in future studies to further examine the moderating role of structural aspects of the self on the effect of sport and exercise on self-esteem.

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Appendix/Anhang

Appendix A: Publication 1

Ennigkeit, F., & Hänsel, F. (2018). Factorial and convergent validity of the Exercise Identity Scale in a German adult sample. *Measurement in Physical Education and Exercise Science*. **Advance online publication. doi:10.1080/1091367X.2018.1474113**

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2   Factorial and convergent validity of the Exercise Identity Scale in a German adult sample

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16   Date of submission: June 29, 2017

17   Date of resubmission: June 16, 2018

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19   **Abstract**

20   The purpose of the present study was to examine the factorial and convergent validity of the

21   German translation of the Exercise Identity Scale (EIS; Anderson & Cychosz, 1994). We

22   introduce a bifactor model as a possible alternative to the previously discussed one- and two-

23   factor models. Using an online study with 530 participants, our results suggest that the EIS

24   should be considered a unidimensional measure. For this one-factor model, temporal invariance

25   (time interval: two weeks) and invariance between men and women could be established.

26   Relations to similar constructs were in the expected directions. We provide a psychometrically

27   sound German version of the EIS which demonstrated factorial and convergent validity in this

28   study. The use of the scale in German samples is likely to advance research on exercise adoption

29   and maintenance by integrating the exercise identity construct.

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32   *Keywords*: exercise psychology; scale validation; confirmatory factor analysis; invariance

33   testing; bifactor model

34   Factorial and convergent validity of the Exercise Identity Scale in a German adult sample

35   **Introduction**

36   Interventions designed to promote sustained exercise behavior have often been based on

37   social cognitive models (e.g., social cognitive theory; Bandura, 1986). Although these

38   interventions have proven useful, their success in changing exercise behavior is modest on

39   average (Conn, Hafdahl, & Mehr, 2011; Prestwich et al., 2014). This has prompted interest in the

40   examination of other concepts aimed at increasing exercise adherence, one of them being self-

41   related variables such as exercise-self-schema and exercise identity (Rhodes, Kaushal, &

42   Quinlan, 2016). Stemming from a symbolic interactionist perspective, exercise identity can be

43   defined as the "salience of an individual's identification with exercise as an integral part of the

44   concept of self" (Anderson & Cychosz, 1994, p. 747). Identities and behavior are assumed to be

45   reciprocally related (Burke & Stets, 2009): Exercise identity is derived from, and gives meanings

46   and value to past experience with exercise, but also guides future exercise behavior and therefore

47   is an important predictor of exercise engagement (Anderson & Cychosz, 1994; Stets & Burke,

48   2003). Accordingly, exercise identity has been linked empirically not only to *exercise behavior*

49   (e.g., frequency and duration, Anderson, Cychosz, & Franke, 1998, 2001; exercise self-schema,

50   Berry, Strachan, & Verkooijen, 2014; Rhodes et al., 2016; stages of exercise adoption, Anderson,

51   Cychosz, Panton, and Browder, 2003), but also to a number of social cognitive and affective

52   variables central to the regulation of exercise (for reviews see Rhodes et al., 2016; Sabiston,

53   Whitehead, & Eklund, 2012; Strachan & Whaley, 2013). For example, identity-congruent

54   behavior is supposed to lead to increased *self-efficacy* (Stryker & Burke, 2000) and research

55   shows that exercise identity and exercise-related self-efficacy are indeed positively correlated

56   (e.g., Strachan, Perras, Brawley, & Spink, 2016; Vlachopoulos, Kaperoni, Moustaka &

57   Anderson, 2008). In a similar vein, *perceived competence* and identity are linked empirically

58   (e.g., Wilson & Muon, 2008). Both exercise identity and *physical self-worth* tap into self-

59   perceptions concerning the physical domain. Because physical self-worth is related to exercise

60   behavior (e.g., Moore, Mitchell, Beets, & Bartholomew, 2012), which in turn is associated with

61   exercise identity, a positive association between physical self-worth and EIS scores is to be

62   expected.

63   **Measurement of Exercise Identity**

64   Most of the research on exercise identity has used the Exercise Identity Scale (EIS) that

65   was originally developed by Anderson and Cychosz in 1994. The EIS has since been translated

66   to Greek (Vlachopoulos et al., 2008), Spanish (Modroño, Guillén, & González, 2010), and

67   Chinese (Hsu & Lu, 2010).

68   (Table 1 about here)

69   The questionnaire consists of 9 items (see Table 1) to be rated on a 7-points Likert format

70   from strongly disagree (1) to strongly agree (7). The authors report strong internal consistency (α

71   = .94) and test-retest reliability (*r* = .93, one week interval). Similar values have been reported in

72   a number of studies, including the translated versions (e.g., α = .96/.94 for the Spanish/Greek

73   version, and *r* = .90/ICC = .99 for the test-retest-reliability of the Spanish/Greek version).

74   Evidence for the construct validity of the EIS has also been provided, e.g. positive associations

75   with self-reported exercise behavior (Anderson & Cychosz, 1994; Anderson, Cychosz, &

76   Franke, 1998, 2001). Furthermore, Cardinal and Cardinal (1997) found changes in EIS scores in

77   a longitudinal setting, consistent with postulated changes in exercise identity. Preliminary norms

78   for the EIS have been established (Anderson et al., 2001). No significant differences in exercise

79   identity between men and women have been found in most studies (Anderson & Cychosz, 1994;

80   Anderson et al., 2001; Modroño et al., 2010), and no or only weak associations between age and

81   exercise identity have emerged (Anderson et al., 2001; Wilson & Muon, 2008).

82   Regarding the dimensionality of the scale, exploratory factor analyses collectively

83   yielded support for a unidimensional factor solution, explaining around 60 to 80% of the

84   variance (e.g., Anderson & Cychosz, 1994; Anderson et al., 1998; Hsu & Lu, 2010; see also

85   Strachan, Brawley, Spink, & Glazebrook, 2010, for a version adapted to physical activity). For

86   the translated versions, this unidimensional structure was also supported using confirmatory

87   factor analysis (CFA; Hsu & Lu, 2010; Modroño et al., 2010; Vlachopoulos et al., 2008).

88   Furthermore, for the Greek version, Vlachopoulos et al. (2008) demonstrated configural and

89   partial metric factorial invariance across sex and culture (Greece vs. USA) for this one-factor

90   model.

91   However, Wilson and Muon (2008) found support for a better fitting two-factor model,

92   which consisted of a Role Identity and an Exercise Beliefs factor. This model was mainly

93   empirically driven. The authors inspected the modification indices of the unidimensional CFA

94   model, which showed acceptable fit to the data in their study. The Role Identity factor consists of

95   three items (items 1, 2, 6 in Table 1) and is thought to reflect the "salience with which the role of

96   being an exerciser has been assimilated into one's identity" (Wilson & Muon, 2008, p. 126),

97   whereas the six-item Exercise Beliefs factor (items 3, 4, 5, 7, 8, 9 in Table 1) deals with

98   "relevant beliefs about exercise previously linked with the salience and strength of identity

99   perceptions" (p. 126). Murray, McKenzie, Newman, and Brown (2013) raise some doubts about

100   the distinct allocation of the items to these factors and argue that the two factors may only

101   emerge due to item format effects. Although subsequent research using CFA has found better

102   model fit for the two-factor than for the one-factor model (Murray et al., 2013; Vlachopoulos,

103   Kaperoni, & Moustaka, 2011), all studies found high correlations between the two factors ($r =$

104   .84–.88), indicating that the two scales are more or less assessing the same construct. Besides,

105   when evaluating model fit in CFA, the principle of model parsimony should be considered. This

106   principle states that when two models fit the data similarly well, the more parsimonious model

107   should be preferred (e.g., Brown, 2015). Given the high correlations between the Role Identity

108   and the Exercise Beliefs factor found in studies arguing for the two-factor model, and the fact

109   that in these studies, the one-factor model yielded acceptable to good fit indices as well, it seems

110   justified to interpret the results of these studies in terms of support for the one-factor model as a

111   legitimate alternative to the two-factor model (see also Reifsteck, Gill, & Labban, 2016).

112   In fact, many researchers have continued to use the EIS as a unidimensional measure in

113   their studies (e.g., Perras, Strachan, & Fortier, 2016). Further examination of the factor structure

114   of the EIS is thus warranted (Murray et al., 2013).

115   **The Present Study**

116   Against this background, the aims of the present study were twofold: First, we wanted to

117   examine the reliability and construct validity of a translated German version of the EIS. To test

118   the latter, we drew on information about the internal structure, the robustness of the internal

119   structure across groups and time (factorial invariance), and relations to similar constructs.

120   Second, when examining the internal structure, we add to the literature by introducing a bifactor

121   approach to model the multidimensionality of the EIS in addition to the previously discussed

122   one- and two-factor models.

123   **Factor structure.** Based on the inconsistent findings concerning the factorial structure of

124   the EIS, we decided to compare three models: the one- and two-factor models described above,

125   as well as a bifactor model. In a bifactor model, the covariance among a set of observed item

126   responses is explained by (a) a general factor accounting for the communality shared by all

127   items, and (b) multiple group factors (sometimes called domain-specific factors) accounting for

128   additional common variance among clusters of items that are highly similar in content (Reise,

129   2012; Rodriguez, Reise & Haviland, 2016). The general factor represents the "target" construct a

130   scale was developed to measure (in the present case, exercise identity), and the group factors (or

131   specific factors) represent subdomains of the target construct (in the present case, Role Identity

132   and Exercise Beliefs). Myers and colleagues have made a case for the use of bifactor modelling

133   in sport and exercise psychology (Myers, Martin, Ntoumanis, Celimli, & Bartholomew, 2014),

134   and several studies in the field have recently applied this type of analysis (e.g., Chung, Liao,

135   Song, & Lee, 2016; Myers et al., 2016). One advantage of the bifactor model over a second-

136   order model (the second-order factor corresponds to the general factor in the bifactor model) is

137   that item variance can be partitioned into variance due to the general factor, and variance due to

138   the group factors. We can therefore tell how much unique variance is explained by the group

139   factors when the general factor is accounted for. In order to consider the EIS a bidimensional

140   construct, the correlation between the two factors should be moderate at most (two-dimensional

141   model) and the two group factors should explain a substantial amount of variance in comparison

142   to the general factor (bifactor model).

143   **Factorial invariance across sex and temporal invariance.** Meaningful comparison of

144   scale scores necessitates the demonstration of factorial (or measurement) invariance across the

145   compared groups (Byrne, 2012). If factorial invariance can be demonstrated, this indicates

146   robustness of the factor structure and that the same construct is being measured across groups. In

147   analogy to the Greek translation (Vlachopoulos et al., 2008), we expected the factorial structure

148   of the best fitting model to be invariant to sex. Furthermore, we hypothesized invariance of the

149 factor structure across the test and retest sample measured 14 days apart (i.e., temporal

150 invariance).

151   **Relations to similar constructs.** We expected EIS scores to be positively associated with

152 the conceptually related constructs of self-reported exercise behavior, exercise-related self-

153 efficacy, perceived sports competence, physical self-worth, exercise self-schema, and stages of

154 exercise adoption. As a control analysis, we also tested the association between EIS scores and

155 social desirability. Self-report measures are often susceptible to socially desired responses. If EIS

156 scores were affected by socially desired responses, this would reduce the utility of the scale in

157 subsequent research. Therefore, we expected no correlation between these two constructs.

158   **Methods**

159 **Translation Procedures**

160   We based the translation of the EIS on the recommendations for cross-cultural

161 translations described by Hambleton (2005), as well as Banville, Desrosiers, and Genet-Volet

162 (2000). Seven individuals, some of them bilingual and one of them a professional translator,

163 prepared a German version of the EIS in a multi-step procedure including back translation. A

164 particular cross-cultural challenge was the translation of "exercise" into German, as the German

165 language does not discriminate between "exercise" and "sports". Depending on item content, we

166 agreed on the terms "sportliche Aktivität" and "regelmäßiges Training" to translate "exercise"

167 into German (see Table 1). This version was pretested with $N = 16$ individuals (9 male) between

168 22 and 65 years of age, with varying degrees of exercise behavior. Because hardly any remarks

169 concerned the same issue, and many remarks were related to definitions that could not be

170 provided within the natural limits of a questionnaire, we decided to retain the version given to

171 the pretesters as the final German version (see Table 1).

172   **Sample**

173   A total of $N = 530$ individuals (65% female) between 15 and 75 years of age (M_{age} =

174   30.49 years, $SD = 12.09$) participated in the study. University students comprised about half of

175   the participants (51.3%), followed by gainfully employed individuals (26.6%). Seventy-two

176   percent of the sample stated they exercised regularly. Self-reported engagement in sport and

177   exercise was $M = 6.28$ hours a week ($SD = 3.84$, range = 0.50–30.00 hours[1]), with endurance and

178   fitness activities being the most prevalent types of exercise, followed by team sports. About 42%

179   of those reporting regular participation in sport or exercise indicated they took part in

180   competitive sport.

181   A subsample of $n = 221$ (62.4% female, $M_{age} = 31.70$ years, $SD = 13.37$, range = 15–75)

182   completed the retest measure. Of the retest sample, 71.5% classified themselves as regular

183   exercisers.

184   **Instruments**

185   Apart from the German translation of the EIS described above, the following instruments

186   were included in the study to assess construct validity.

187   **Exercise self-schema.** Exercise self-schema was assessed using the Exerciser Self-

188   Schema Scale by Kendzierski (1988). This questionnaire asks participants to rate to which extent

189   they perceive themselves to be someone who "exercises regularly", "keeps in shape" and "is

190   physically active" on a Likert-type scale ranging from 1 = *not at all self-descriptive* to 11 = *very*

191   *self-descriptive*. In a second step, participants indicate how important (1 = *not at all important* to

192   11 = *very important*) the same three attributes are to the image they have of themselves,

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[1] Although 30 hours per week might seem remarkable at first, the sample was quite diverse in terms of level of exercise and sports engagement. The maximum value (30) was given by a triathlete on the national level, which seems plausible. We therefore decided to retain the data of this participant. The second highest value was 20 hours per week.

193   regardless of whether or not the attribute describes them. In both cases, twelve filler items (e.g.,

194   "someone who is spontaneous", "someone who reads books regularly") are included to avoid

195   bias. Participants who rate at least two of the three items as extremely self-descriptive (8–11

196   points) and at the same time as extremely important to their self-image (8–11 points) are

197   classified as exercise schematics. Deviating from Kendzierski's original classification system

198   (schematics, aschematics, nonschematics, and unclassified participants), that leaves large parts of

199   the sample unclassified, we categorized the remaining participants as unschematics (i.e., not

200   having an exercise self-schema), following the approach taken by some authors (e.g., Sheeran &

201   Orbell, 2000).

202   **Exercise self-efficacy.** We assessed exercise self-efficacy with the exercise self-efficacy

203   scale by Fuchs and Schwarzer (1994). This German 12-item scale addresses the belief of being

204   able to stick to a planned exercise program even under unfavorable circumstances. Participants

205   rate how confident they are about being able to exercise as planned even when barriers occur that

206   could potentially get in the way of exercising (e.g., being tired, having a lot of work to do, bad

207   weather conditions) on a seven-point Likert-type scale (1 = *not at all confident*, 7 = *very*

208   *confident*). The authors report an internal consistency of α = .89 and provide evidence for the

209   convergent and discriminant validity of the scale.

210   **Perceived sports competence.** Sports competence was assessed with the corresponding

211   subscale of the Physical Self-Description Questionnaire (PSDQ; Marsh, Richards, Johnson,

212   Roche & Tremayne, 1994; German translation by Stiller & Alfermann, 2007). It is a specific

213   component of physical self-concept that focuses on whether the individual thinks of

214   himself/herself as being good at sports, being athletic and having good sports skills (Marsh,

215   1996). The German version of this subscale ("Sportkompetenz") consists of six items to be rated

216   on a six-point scale (1 = *strongly disagree*, 6 = *strongly agree*). Stiller and Alfermann (2007)

217   provide evidence for both the internal consistency (α = .82–.94) and the construct validity of this

218   subscale.

219   **Physical self-worth.** To assess physical self-worth, we used the global physical self-

220   concept subscale of the PSDQ (Marsh et al., 1994; German translation by Stiller & Alfermann,

221   2007). This subscale measures how positive individuals feel about their physical self (Marsh,

222   1996) with six items. Stiller and Alfermann (2007) report good internal consistencies (α = .91–

223   .93) and expected correlations with external criteria such as sex, age and sport participation for

224   responses to this subscale.

225   **Exercise behavior.** We used a portion of the Godin Leisure-Time Exercise Questionnaire

226   (GLTEQ; Godin & Shepard, 1985) to assess self-reported exercise behavior. Participants report

227   the number of strenuous, moderate and mild exercise sessions (minimum duration of 15 minutes)

228   in which they engaged during a typical week. The measure provides examples of activities that

229   can be considered mild, moderate, or strenuous. The reported frequencies are multiplied by their

230   estimated value in metabolic equivalents (METs; 9, 5, and 3, respectively) to form scores for the

231   three types of exercise. Evidence for the reliability of responses to the GLTEQ has been reported

232   (e.g., test-retest reliability of r = .94 for strenuous exercise; Godin & Shepard, 1985) and

233   positive, significant correlations have been found between GLTEQ scores and physiological as

234   well as anthropometric measures such as VO_2max, body fat, or energy expenditure (e.g., Gionet

235   & Godin, 1989).

236   Second, we assessed the current stage of exercise engagement based on the

237   transtheoretical model of behavior change (Prochaska & DiClemente, 1983) with a single item

238   developed by Lippke, Ziegelmann, Schwarzer, and Velicer (2009). Participants were asked

239   whether they usually engage in physical activity at least five days a week for 30 minutes or more

240   (or 2.5 hours in total) in such a way that they are at least somewhat exhausted. Responses were

241   given on a rating scale with the anchors *No, and I do not intend to start* (precontemplation stage),

242   *No, but I am considering it* (contemplation), *No, but I seriously intend to start* (preparation), *Yes,*

243   *but it is very hard for me* (action), and *Yes, and it is easy for me* (maintenance).

244   Finally, participants who stated they exercised regularly provided some additional

245   information on their exercise and sports behavior (e.g., hours/week).

246   **Social desirability.** Social desirability was assessed with the Soziale-

247   Erwünschtheitsskala-17 (Stöber, 2001). This 17-item measure was developed as a more recent

248   German version along the lines of the Social Desirability Scale (Crowne & Marlowe, 1960).

249   Each item is rated on a dichotomous true-false format, and a sum score is formed as a measure of

250   social desirability. Example items include "I like to gossip at times" (reverse coded) or "I always

251   eat healthy". Reliability ($\alpha = .75$, $r_{tt} = .81$) and construct validity of the scale have been reported

252   (Stöber, 2001).

253   **Procedure**

254   The study was conducted online using the SoSci Survey software (Leiner, 2015). We

255   followed recommendations for successful online research when designing the study (e.g., Reips,

256   2007). The convenience sample was recruited via mailing lists, social networks, internet forums,

257   and notices posted on campus. All participants agreed to informed consent at the beginning of

258   the study. Participants who left an e-mail address automatically received an invitation to the

259   retest study 14 days after they completed the first study. Due to the online nature of the study,

260   not all participants worked on the retest exactly 14 days after the first data collection. The time

261   interval between the test and the retest measurements was $M = 15.16$ days ($SD = 1.89$). In the

262   retest study, participants rated the EIS items only. All participants who completed both parts of

263   the study were invited to take part in a drawing for gift cards (5 x 20 €).

264   **Data Analysis**

265   To validate the German translation of the EIS, we first examined the factor structure and

266   then tested temporal invariance and factorial invariance across sex for the best fitting model.

267   Finally, we analyzed relations to similar constructs. Preliminary analyses were conducted using

268   IBM SPSS version 23. All CFAs were conducted in Mplus 7.4 (Muthén & Muthén, 1998-2015).

269   Significance testing was performed at a .05 level. Confirmatory factor analyses used full

270   information maximum likelihood to account for missing data. For temporal invariance testing,

271   only data of individuals who provided answers for both measurements were included.

272   For all CFAs, goodness of model fit was evaluated by conventional fit indices, namely

273   the chi-square goodness-of-fit statistic, the comparative fit index (CFI), the Tucker-Lewis index

274   (TLI), the root mean square error of approximation (RMSEA), and the standardized root-mean

275   square residual (SRMR). Traditional cutoff criteria were used to indicate acceptable and good fit,

276   respectively (CFI and TLI > .90/.95, RMSEA and SRMR < .08/.05; Byrne, 2012; Hu & Bentler,

277   1999). When nested models were compared (factor structure and invariance testing), we used

278   chi-square difference testing in which non-significant results support the more restrictive model.

279   However, as the chi square difference tests tend to be overly sensitive to group differences

280   resulting in false rejections of factorial invariance, Cheung and Rensvold (2002) suggest that

281   changes in CFI should not exceed .01 in order to assume invariance, so we draw on CFI change

282   as well.

283   **Factor structure.** Regarding the factor structure of the German EIS, we compared three

284   models: For the one-factor model (model 1), all nine items load on the latent EIS factor. Model 2

285   is the two-factor model described by Wilson and Muon (2008), in which items 1, 2, and 6 load

286   on the Role Identity and all other items load on the Exercise Beliefs factor (see Table 1). The

287   correlation between the latent factors was freely estimated. Model 3 is the bifactor model. In this

288   model, all nine items load on the general exercise identity factor. Each of the items additionally

289   loads on one group factor (Role Identity and Exercise Beliefs). All latent factors were specified

290   to be orthogonal in this model. For all models, the latent factor variance was fixed to 1.

291   For the bifactor model, through examination of the factor loadings, the strength of the

292   relationship between the group factors and their associated items can be taken into consideration

293   directly (Reise, 2012). The following additional analyses were performed to further examine the

294   nature of the bifactorial scale structure (see Reise, 2012, and Rodriguez et al., 2016, for details):

295   The explained common variance (ECV) is the variance explained by the general factor divided

296   by the sum of variance explained by the general and the group factors. A high ECV indicates that

297   the general factor is strong in relation to the group factor (i.e., if the group factors explained no

298   additional variance, the ECV would equal 1), and suggests that modeling the data as

299   unidimensional seems justified. Omega hierarchical (ω_H) serves as a measure to judge whether

300   composite scale scores reflect a common single factor, with high ω_H values suggesting a

301   composite score to be a good measure of one single factor. To compute ω_H, the sum of the factor

302   loadings on the general factors is squared and then divided by the (modeled) variance of scale

303   scores. The logic of ω_H can be extended to the estimation of subscale reliability ω_S to control for

304   the effects of the general factor. These coefficients for the subscales help to decide whether the

305   computation of subscale scores is reasonable. To enable comparisons with previous studies, we

306   also computed internal consistency scores (Cronbach's α).

307   **Temporal invariance.** After having established a well-fitting model, step two examined

308   whether the hypothesized factor structure holds across time. Only if temporal factorial invariance

309   is supported, comparisons of latent EIS scores in longitudinal studies are interpretable. For this

310   analysis, only data of the retest sample (for both measurement points) were used. We established

311   a series of latent state models with autocorrelated error variables (Geiser, 2012). First, for the

312   configural invariance model, the same pattern of factors and loadings across both measurements

313   was assumed. Variance of the latent constructs was fixed to 1. All factor loadings and intercepts

314   varied freely. Second, in the metric invariance model factor loadings were constrained to be

315   equal. Third, both the factor loadings and the intercepts were assumed to be time-invariant in the

316   scalar invariance model. We also tested for differences in the latent EIS means. To enable

317   comparisons with previous studies, we also computed test-retest reliability.

318   **Factorial invariance across sex.** To test invariance across sex, we performed a series of

319   multiple group CFAs (Byrne, 2012) for the best-fitting model. These analyses permit

320   simultaneously estimating the factor structure in two prespecified groups (male and female). Just

321   as for the temporal invariance testing, we compared the configural to the metric and the metric to

322   the scalar invariance model. To identify latent variables, we fixed the variance of the latent

323   constructs to 1.

324   **Relations to similar constructs.** Associations between EIS scores and other theoretically

325   meaningful measures were calculated by means of latent correlations and latent regression. For

326   the latent regression regarding exercise adoption, the five stages of the transtheoretical model

327   were dummy-coded, using the maintenance stage group as the reference category.

328   **Results**

329   **Preliminary analyses**

330   Descriptive statistics for the EIS items can be found in Table 2. Due to multivariate non-

331   normality of the data (Royston's $H = 488.15$, $p < .001$), all subsequent models were estimated

332   using robust maximum likelihood (MLR). Also, the robust version of the chi-square difference

333   test was used to compare nested models (Satorra & Bentler, 2001).

334   (Table 2 about here)

335   **Factor structure**

336   With the exception of RMSEA values, which were in the acceptable range, all three

337   tested models fit the data well (one-factor model: $SB\chi^2(27) = 119.56$, $p < .001$; CFI = .969, TLI =

338   .959; RMSEA = .080 [90% CI = .066–.095], SRMR = .019; two-factor model: $SB\chi^2(26) =$

339   106.58, $p < .001$; CFI = .973; TLI = .963; RMSEA = .076 [90% CI = .062–.092], SRMR = .019;

340   bifactor model: $SB\chi^2(18) = 50.58$, $p < .001$; CFI = .989; TLI = .979; RMSEA = .058 [90% CI =

341   .040–.078], SRMR = .013).

342   Inspection of factor loadings (presented in Table 2) reveals that for both the one- and the

343   two-factor model, the items seem to be fairly good measures of their respective dimensions, and

344   indicate high homogeneity of the items. The factor loadings show only minor increases when

345   dividing the scale into two dimensions. For the general factor of the bifactor model, factor

346   loadings are very similar to those in the one- and two-factor models, but when partialling out the

347   common variance, factor loadings for the group factors are very low for all items, and even

348   negative for three (3, 4, 5) items of the Exercise Beliefs factor.

349   The one-factor model exhibited significantly worse fit according to the robust chi-square

350   difference test, but not according to the change in CFI ($\Delta SB\chi^2 = 12.31$, $\Delta df = 1$, $p < .001$; $\Delta CFI =$

351   −.004). The two-factor model fit the data significantly worse than the bifactor model according

352   to both the chi square difference test and the change in CFI ($\Delta SB\chi^2 = 51.13$, $\Delta df = 8$, $p < .001$;

353   ΔCFI = .016), indicating better model fit for the more restrictive models than for the less

354   restrictive ones. Taken together, the model fit indices, the significant chi-square difference tests

355   indicate that statistically, the bifactor model was best supported in this sample.

356   However, further examination of the relation between the general and the group factors in

357   the bifactor model revealed an ECV of .96, indicating that the general exercise identity factor is

358   very strong in relation to the group factors. Furthermore, ω_H was .96 for the general exercise

359   identity factor, and ω_S was .05 for the Role Identity, and < .01 for the Exercise Beliefs factor,

360   respectively. These values demonstrate that if both total scores and subscale scores were to be

361   computed, the interpretation of the subscales as accurate indicators of distinctive constructs

362   would be extremely limited—no reliable variance exists beyond that due to the general factor.

363   For comparison purposes with previously published studies, Cronbach's α was .97 for the

364   unidimensional exercise identity factor, .92 for role identity, and .95 for exercise beliefs.

365   To conclude, the results show that although the bifactor model is best supported by the

366   model fit indices and the chi square difference test, both the factor loadings and additional

367   statistical indices derived from the bifactor model indicate that it seems unjustified to treat the

368   Role Identity and the Exercise Beliefs factors separately. Besides, in the two-factor model, the

369   latent factors were highly intercorrelated, $r = .98$ ($p < .001$), indicating that the two factors

370   measure an identical concept. Furthermore, change in CFI was only minimal when comparing

371   the one- and the two-factor model. We therefore decided to proceed with the parsimonious one-

372   factor model for all subsequent invariance testing.

373   **Temporal invariance**

374   We expected the internal structure of the EIS to be robust and equivalent across the two

375   measurement points. The invariance tests of the one-factor model resulted in non-significant chi-

376   square difference tests for measurement time and the change in CFI did not exceed .01 (see

377   Table 3), suggesting that neither the factor structure nor the factor loadings nor the intercepts of

378   the model did change significantly during a period of approximately 15 days. The latent factors

379   for the two measurement points were highly correlated, $r = .97$, suggesting a high stability of the

380   EIS mean score. Also, restricting the latent factor means to be equal in the scalar invariance

381   model did not lead to a significant decrease in model fit compared to the model with freely

382   estimated latent means, $\chi^2(142) = 271.99$, $p < .001$, CFI = .965, TLI = .964, RMSEA = .064

383   [90% CI = .052.–075], SRMR = .028, $\Delta\chi^2 = 0.003$, $\Delta df = 1$. This suggests that the latent means

384   ($M_{t1} = 2.82$, $SD_{t1} = 0.19$, $M_{t2} = 2.98$, $SD_{t2} = 0.20$) did not differ significantly between the two

385   measurements.

386   (Table 3 about here)

387   For comparison purposes with previously published studies, we also computed the test-

388   retest reliability for manifest EIS mean scores, which was $r = .95$, $p < .001$.

389   **Factorial invariance across sex**

390   Results of the multiple group CFAs across men and women for the one-factor model are

391   presented in Table 3. Both restricting the factor loadings and additionally restricting the

392   intercepts to be equal led to a significant decrease in model fit according to the robust chi square

393   difference tests. However, all models showed good fit indices (with the exception of the

394   RMSEA), and the change in CFI did not exceed .01. The results regarding invariance across sex

395   are therefore mixed.

396   **Relations to similar constructs**

397   Latent correlation analyses showed that EIS scores were positively associated with

398   exercise behavior, namely frequency of exercise (hours/week), $r = .55$, $p < .001$, as well as

399   strenuous, $r = .69$, $p < .001$, and moderate exercise behavior as measured by the GLTEQ, $r = .38$,

400    $p = .002$. Mild exercise was not significantly related to exercise identity, $r = -.02$, $p = .671$.

401   Furthermore, we found positive correlations between exercise identity and exercise-related self-

402   efficacy, $r = .76$, $p < .001$, exercise identity and sports competence, $r = .69$, $p < .001$, as well as a

403   positive, albeit lower, correlation between exercise identity and physical self-worth, $r = .32$, $p <$

404   .001. We found no association between exercise identity and social desirability, $r = .05$, $p = .525$.

405   Exercise schematics (1, $n = 255$) and unschematics (0, $n = 238$) differed in their EIS

406   scores, $b = -1.915$, $SE\ B = 0.14$, $\beta = -.69$, $p < .001$, $R^2 = .48$, with unschematics scoring lower on

407   the EIS than schematics. Finally, the stage of exercise adoption in the transtheoretical model of

408   behavior change was a significant predictor of EIS scores, $R^2 = .45$, $p < .001$. Individuals in the

409   maintenance stage scored higher than individuals in all other stages (precontemplation:

410    $b = -2.40$, $SE\ B = 0.25$, $\beta = -.47$, $p < .001$; contemplation: $b = -2.14$, $SE\ B = 0.23$, $\beta = -.49$, $p <$

411   .001; preparation: $b = -1.58$, $SE\ B = 0.17$, $\beta = -.41$, $p < .001$; action: $b = -0.87$, $SE\ B = 0.16$, $\beta =$

412    $-.20$, $p < .001$).

Discussion

414   The purpose of the present study was to analyze the reliability and construct validity of a

415   German translation of the EIS, and, in addition, to add to the literature by reexamining the

416   factorial structure of the instrument. All three models tested in this study (one-factor, two-factor,

417   bifactor) showed good fit indices, with the exception of the RSMEA for which the recommended

418   cut-off criterion of .08 was included in the 90% confidence interval of both the one- and the two-

419   factor model. According to the fit indices and the chi square difference test, the two-factor model

420   fit the data better than the one-factor model. However, the two factors showed a near perfect

421   intercorrelation ($r = .98$). Based on the principle of parsimony (Byrne, 2012), we decided that

422   there is no good reason to differentiate between the two factors as they essentially assess the

423   same construct. Likewise, although the bifactor model showed the best fit indices, and the chi

424   square difference test suggested an improved fit over the two-factor model, inspection of the

425   factor loadings as well as other parameters derived from the bifactor model (ECV, omega

426   hierarchical, subscale omegas) led us to believe that the best choice is to consider the EIS as

427   measuring a unidimensional underlying factor. This decision is also supported by the conceptual

428   definition of the construct and by previous empirical research that found acceptable to good fit

429   for the unidimensional model as well.

430   The decision to retain a one-factor structure can be discussed on a theoretical as well as

431   on a methodological level. On a theoretical level, we must take into account that the definition of

432   the exercise identity construct and the development of the EIS have been largely atheoretical

433   (Sabiston et al., 2012). The items of the EIS seem to be derived rather intuitively from what it

434   means to have a salient exerciser identity (Anderson & Cychosz, 1994). Also, the proposed two-

435   factor model has been primarily based on statistical reasoning (inspection of modification

436   indices), and few arguments have been made for the underlying theoretical distinction between

437   the Exercise Beliefs and the Role Identity factors, which casts doubt about the psychological

438   meaning of these factors. If exercise identity truly is represented best by a multidimensional

439   structure, a reconstruction of the measure derived more directly from the tenets of identity theory

440   (e.g., Burke & Stets, 2009) and on relevant literature in the exercise domain (e.g., commitment

441   and perceived ability in the model of self-definition by Kendzierski and Morganstein, 2009) is

442   warranted. On the other hand, exercise identity to date has been treated mainly as a

443   unidimensional construct, and has proven to be a promising construct to complement social

444   cognitive or stage-based models of behavior within the promotion and maintenance of exercise

445   behavior research.

446   On a methodological level, bifactor modelling assumes orthogonality and thus

447   independence between the two group factors. While this assumption is plausible from a statistical

448   point of view, it is "unlikely to reflect the structure of real-world psychological data" (Reise,

449   2012, p. 692), because two subdimensions of the same psychological construct are naturally

450   expected to correlate. Besides, it is not unusual for bifactor models to lead to anomalous results.

451   As a solution, Eid and colleagues propose modeling the data in a way in which one domain is

452   used as a reference domain (bifactor-$(S-1)$ model), or in which one item or scale is used as a

453   reference indicator (bifactor-$(S \cdot I - 1)$ model; Eid, Geiser, Koch, & Heene, 2016).

454   EIS sum or mean scores are routinely used to reflect the extent of exercise identity, and

455   changes in sum or mean scores are used to represent differences in true scores. This

456   interpretation is valid only to the extent that the measurement properties of the EIS are invariant

457   across time (temporal invariance) and across different subgroups in comparative analyses,

458   although different kinds of invariance are required for different kinds of tests (Borsboom, 2006).

459   To our knowledge, this is the first study to test the temporal invariance of the EIS structure.

460   Results suggest that both factor loadings and intercepts can be assumed to be equivalent over a

461   time period of about two weeks. This indicates that the EIS is suitable to measure changes in

462   exercise identity and that changes in EIS scores represent actual differences in the construct

463   measured through the rating scale. Exercise identity is assumed to be a relatively stable

464   construct, changing only as a result of ongoing threats (Sabiston et al., 2012). Still, exercise

465   interventions have shown to change exercise identity as measured by the EIS (Cardinal &

466   Cardinal, 1997). It is possible that temporal invariance may not hold when exercise identity

467   scores change considerably after a longer exercise intervention period.

468   Regarding measurement equivalence across sex, invariance did hold only according to

469   the change in CFI, not according to the results of the chi square difference test. In a similar vein,

470   for the Greek translation, findings support only partial metric and scalar invariance across sex

471   (Vlachopoulos et al., 2008), so it is possible that men and women do not interpret all EIS items

472   in the same way. However, our result regarding invariance across sex for the German translation

473   must be interpreted tentatively and needs replication in independent samples to determine the

474   efficiency and precision of the sample estimates (Lubke & Campbell, 2016).

475   Relations to similar constructs were generally in the expected directions, and comparable

476   to those found in other studies, confirming the convergent validity of the German translation in

477   the current sample. EIS scores were positively associated with moderate and strenuous exercise

478   behavior as measured by the GLTEQ. Consistent with other studies (Strachan & Brawley, 2008;

479   Strachan, Woodgate, Brawley, & Tse, 2005), strenuous exercise seems to be most representative

480   of physical activity intensity that exercisers consider to be characteristic of their exercise

481   identity, whereas mild forms of exercise (e.g., easy walking, archery, bowling) show no relation

482   to exercise identity, which was the case in our study as well. This could be partly due to the fact

483   that light exercise is less easy to recall (Cust et al., 2008).

484   Exercise self-efficacy was strongly associated with exercise identity which replicates the

485   results of a number of other studies (e.g., Strachan & Brawley, 2008; Strachan et al., 2016;

486   Vlachopoulos, 2008). Self-efficacy has been proposed to mediate the relationship between

487   exercise identity and behavior (Strachan, Brawley, Spink, Sweet, & Perras, 2015), which is in

488 line with identity theory assumptions that identities act as self-regulation control systems linking

489 identity to behavior through variables such as efficacy beliefs (Stryker & Burke, 2000).

490   Perceived sports competence was strongly related to exercise identity. To our knowledge,

491 the perceived sport competence subscale of the PSDQ has not been used for validation of the

492 English original. However, Wilson and Muon (2008) used the Psychological Need Satisfaction in

493 Exercise Scale (Wilson, Rodgers, Rodgers, & Wild, 2006) and found comparable correlations

494 between the perceived competence subscale and exercise identity. Kendzierski and Morganstein

495 (2009) found that perceived ability directly affected the physical activity self-definition.

496 Perceived competence therefore seems to be strongly linked to identity. Competence is one of

497 the key factors in self-determination theory (Deci & Ryan, 2002), and several authors have

498 argued that it could be fruitful to integrate the exercise identity construct into self-determination

499 theory to further advance research on exercise adoption and maintenance (Strachan & Whaley,

500 2013; Vlachopoulos et al., 2011).

501   To our knowledge, this study is the first to link physical self-worth to exercise identity,

502 resulting in a moderate correlation. We measured global physical self-worth (Marsh et al., 1994),

503 so item content was not specifically related to exercise (e.g., "Physically, I feel good about

504 myself") hence a lower association was to be expected. Still, engaging in exercise behavior leads

505 to positive changes in physical self-concept (e.g., Campbell & Hausenblas, 2009), so it makes

506 sense from a theoretical perspective that exercise identity and physical self-worth are correlated

507 at least moderately.

508   Exercise schematics and unschematics differed significantly in their EIS scores. This

509 result is in line with the studies of Berry et al. (2014), and Rhodes et al. (2016). The latter argue

510 that "the identity and schema conceptualizations did not show functional differences in terms of

511   their relationship with behavior or their correlates and processes" (p. 220), so they suggest that

512   both constructs can be considered commensurate and future research should merge these two

513   approaches. In our opinion, it might be more feasible to use the EIS than the exercise schema

514   scale, as the continuous EIS construct (in contrast to the categorical outcome of the schema

515   construct) might provide the range needed to further examine the interplay between exercise

516   behavior and social-cognitive constructs.

517   Finally, individuals in different stages of the transtheoretical model differed in their

518   exercise identity strength, with individuals in the maintenance stage exhibiting the highest EIS

519   scores. This is consistent with the results of Anderson et al. (2003) who found that exercise

520   identity explained 40% of the variance in exercise stage. These results suggest that it could be

521   fruitful to integrate exercise identity theory into stage theories of health behavior change.

522   As predicted, no correlation was found between exercise identity and social desirability.

523   Self-perception measures in sport sometimes reflect a social desirability bias (Williams & Krane,

524   1989), but our results suggest that this is not the case for the EIS. By examining associations of

525   EIS scores with social desirability, we meet the demand of Sabiston et al. (2012) who encourage

526   researchers to account for social desirability in self-concept research.

527   **Limitations and future directions**

528   Despite the theoretical and practical implications of this study, interpretation of results

529   should be evaluated in relation to a number of limitations. One possible limitation of the study is

530   the generalizability of the findings. Although our sample covered a relatively wide age range,

531   there still was a disproportionately high number of young and better educated individuals,

532   women, and exercisers in our sample. Cross-validation studies are also warranted because some

533   doubts remain about the factor structure and measurement invariance of the EIS across different

534   groups. This is especially true for the invariance testing across sex, as the group of men was not

535   extremely large, resulting in a possibly low stability of estimates of variance and covariance.

536   Another possible limitation concerns the extent to which our results regarding the

537   dimensionality of the scale can be extrapolated to the original English scale. Strictly speaking,

538   our decision to retain the one-factor model after evaluating alternative two- and bifactor models

539   is only valid for the German translation. However, the extensive translation procedure and the

540   results of factor structure and construct validity analyses indicate cultural equivalence between

541   the original and the adapted version. The EIS seems to be quite robust across cultures, yielding

542   comparable results for the English, Spanish, Chinese, Greek, and German versions. It would

543   likely retain sound psychometric properties if carefully translated into other languages (Weeks,

544   Swerissen, & Belfrage, 2007). Besides, results of studies that examined the two-factor structure

545   for the original scale suggest that when taking into account the principle of parsimony, the EIS

546   might in fact represent a unidimensional structure best, which is in accordance with our results.

547   Still, to confirm the finding for the original version, replication with the English EIS is needed.

548   More than 70% of our participants stated they exercised regularly. Differences in EIS

549   scores between exercisers and non-exercisers are frequently reported (e.g., Anderson & Cychosz,

550   1995; Anderson et al., 2001; Berry et al., 2014; Strachan & Brawley, 2008), but it remains

551   unclear whether exercisers and non-exercisers interpret the items of the EIS in a conceptually

552   similar manner. Measurement invariance across different levels of exercise behavior has not

553   been tested yet, and therefore it is possible that the probability of item response is different

554   among different exerciser subgroups with the same underlying level of exercise identity. To what

555   extent our results regarding differences between exercise schematics and unschematics and

556   between individuals in different stages of the transtheoretical model are biased is therefore

557   unknown. In fact, it is probable that invariance of the EIS will not be supported for exercisers

558   and non-exercisers, because factor loading estimates are biased by extreme responses (e.g.,

559   Baumgartner & Steenkamp, 2001), and it is likely that exercisers will respond more extremely to

560   the EIS items. However, this might not be due to different interpretation of item meaning, but to

561   expected response threshold differences between these groups, as exercisers are assumed to score

562   considerably higher on the EIS than nonexercisers. Besides, nonexercisers may have a limited

563   basis for forming self-perceptions in relation to specific EIS items, e.g. item 8 ("I would feel a

564   real loss if I were forced to give up exercising") implies that the respondent is actually exercising

565   currently. This is in line with identity theory which states that previous experience with the

566   relevant behavior is a prerequisite for forming an identity (Burke & Stets, 2009). Vandenberg

567   and Lance (2000) therefore argue that at least scalar invariance testing is not appropriate when

568   such group differences, and consequently intercept differences, are to be expected.

569   Some future research directions to advance the study of identity in exercise using the EIS

570   have already been offered in the previous section. The relationship between exercise identity,

571   exercise behavior and social cognitive variables central to the regulation of exercise has been

572   established in a number of studies (Rhodes et al., 2016). Most of them are cross-sectional in

573   nature, so experimental and longitudinal studies in more diverse samples and with objective

574   measures of exercise are critical in furthering our understanding of the dynamic interplay

575   between the mechanisms that are crucial for self-definition to occur. Also, although we found

576   that the factor structure of the EIS was invariant over a period of around two weeks, whether this

577   invariance holds over longer time periods still needs further examination.

578   Besides, there is still a lack of more complex models that consider the simultaneous

579   effects of the aforementioned social cognitive and affective variables central to the regulation of

580   exercise. Little is known about the formation and maintenance of exercise identity, but

581   expanding research on the interplay between exercise identity acquisition and exercise behavior

582   could help in designing interventions to establish new identities in the exercise domain. Perras et

583   al. (2016) have successfully integrated future-orientated (possible) selves that in turn motivate

584   future behavior into exercise identity research. These possible selves allow individuals to explore

585   different identities and may serve as a tool for changing one's self-concept. It is also possible

586   that interindividual differences exist in the formation of an exercise identity (e.g., Berzonsky,

587   2004) and it would be quite fruitful to study stability or malleability of exercise identity across

588   the lifespan. Also, as the EIS is now available in at least five languages, cross-cultural research

589   on exercise identity and behavior is desirable.

590   To conclude, the current study extends previous research in three important ways. First,

591   we contribute to the discussion of the underlying factor structure of the EIS by comparing not

592   only the one- and the two-factor structures previously discussed in the literature, but by

593   introducing a bifactor model as a possible third solution. However, our findings show that

594   inspecting all relevant parameters collectively indicates that the best choice is to consider the EIS

595   unidimensional. Second, this study is the first to examine temporal invariance of the EIS.

596   Configural, metric, and scalar invariance could be established demonstrating the internal

597   structure of the EIS to be robust and equivalent across a time period of two weeks. Third, we

598   provide a psychometrically sound German translation of the EIS.

599   **Acknowledgments**

602

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804 **Tables**

805 Table 1

806 *Original items (Anderson & Cychosz, 1994) and final German version of the EIS*

No.	Original items	German translation
1	I consider myself an exerciser.	Ich betrachte mich selbst als sportlich aktive Person.
2	When I describe myself to others, I usually include my involvement in exercise.	Wenn ich mich anderen beschreibe, erwähne ich normalerweise meine sportlichen Aktivitäten.
3	I have numerous goals related to exercising.	Ich habe mehrere Ziele, die mit meinem Training zu tun haben.
4	Physical exercise is a central factor to my self-concept.	Regelmäßiges Training ist ein wichtiger Aspekt in meinem Selbstbild.
5	I need to exercise to feel good about myself.	Ich brauche regelmäßiges Training, um mich wohlzufühlen.
6	Others see me as someone who exercises regularly.	Andere sehen mich als jemanden, der regelmäßig trainiert.
7	For me, being an exerciser means more than just exercising.	Ein/e Sportler/in zu sein, bedeutet für mich mehr, als nur Sport zu treiben.
8	I would feel a real loss if I were forced to give up exercising.	Wenn ich gezwungen wäre, das Sporttreiben aufzugeben, wäre das ein großer Verlust für mich.
9	Exercising is something I think about often.	Ich denke oft an meinen Sport.

807 *Note.* Items rated on a 7-points Likert format from strongly disagree (1) to strongly agree (7).

808 Table 2

809 *Descriptive statistics and factor loadings for the three models tested in the study*

Item	*M*	*SD*	One-factor model	Two-factor model		Bifactor model		
			EI	RI	EB	EI (G)	RI	EB
1	4.90	2.30	.890	.900		.876	.172	
2	4.86	2.07	.855	.865		.840	.206	
3	4.83	1.92	.824		.826	.820		−.127
4	4.57	2.06	.923		.926	.936		−.279
5	4.53	2.16	.902		.907	.903		−.077
6	4.26	2.22	.905	.918		.889	.264	
7	4.25	2.01	.732		.733	.739		.135
8	4.25	2.16	.890		.892	.901		.165
9	4.21	2.13	.891		.893	.900		.145

810 *Note.* Items rated on a 7-points Likert format from *strongly disagree* (1) to *strongly agree* (7).

811 Factor loadings estimated under robust maximum likelihood estimation. All factor loadings were

812 significant at a .05 significance level, with the exception of the factor loading of item 5 in the

813 bifactor model (Exercise Beliefs group factor). EI = Exercise Identity, RI = Role Identity, EB =

814 Exercise Beliefs, G = general factor.

815

816 Table 3

817 *Fit indices of the one-factor model for temporal invariance and factorial invariance testing across*

818 *sex*

	χ²	*df*	CFI	TLI	RMSEA [90% CI]	SRMR	Δχ² (Δ*df*)	ΔCFI
Time								
(*n* = 221, measurements *M* = 15 days apart, *SD* = 1.89)								
Configural invariance	245.66	125	.969	.962	.066 [.054–.078]	.023		
Metric invariance	260.28	133	.967	.962	.066 [.054–.078]	.028	13.78 (8)	−.002
Scalar invariance	271.60	141	.966	.963	.065 [.053–.076]	.028	10.37 (8)	−.001
Sex								
(*n* = 344 female, *n* = 184 male)								
Configural invariance	147.19	54	.971	.961	.081 [.065–.097]	.022		
Metric invariance	166.70	62	.967	.962	.080 [.065–.095]	.036	17.79 (8)*	−.004
Scalar invariance	192.96	70	.962	.961	.082 [.068–.095]	.042	27.91 (8)***	−.005

819 *Note.* All chi-square values were statistically significant. Models estimated under robust

820 maximum likelihood estimation. * *p* < .05, *** *p* < .001.

Appendix B: Publication 2

Ennigkeit, F., & Hänsel, F. (2014). Effects of exercise self-schema on reactions to self-relevant feedback. *Psychology of Sport and Exercise, 15*, 108–115. doi:10.1016/j.psychsport.2013.10.008
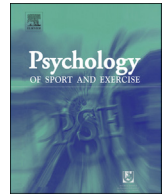
Effects of exercise self-schema on reactions to self-relevant feedback

Fabienne Ennigkeit*, Frank Hänsel

Technical University Darmstadt, Institute of Sport Science, Magdalenenstraße 27, 64289 Darmstadt, Germany

ABSTRACT

Objectives: The purpose of this study was to test the influence of exercise self-schema on the processing of self-relevant information in the sport and exercise domain. It was hypothesized that exercise schematics would cognitively prefer consistent feedback over positive feedback (self-consistency principle), whereas affectively, participants without exercise self-schema would prefer positive feedback over consistent feedback (self-enhancement principle).
Design: Cross-sectional online study with a 2 × 3 mixed model design.
Method: 472 subjects (52.54% female, $M_{age} = 31.35$, $SD = 11.90$) participated in an online-study providing them with bogus test results consistent with as well as positively and negatively deviating from their self-assessments in exercise-related aspects. To measure preference, affective and cognitive reactions were assessed after each feedback presentation.
Results: Mixed-model ANOVAS (between-subject factor: exercise self-schema, within-subject factor: type of feedback) reveal significant interactions for both affective and cognitive reaction. However, these are not based on an interaction of the levels 'consistent' and 'positive' of type of feedback, but on an interaction of 'negative' and 'consistent' feedback. For exercise schematics, the gap between reactions to consistent and negative feedback is larger than for participants without exercise self-schema.
Conclusions: The original hypotheses could not be confirmed, indicating a general dominance of the self-enhancement principle. However, the unexpected interaction suggests that participants with exercise self-schema seem to devalue negative feedback more than those without exercise self-schema, which could be explained by self-consistency principles.

Introduction

People in sport and exercise situations are often confronted with feedback. Such feedback is not only given in terms of technical instructions to improve motor performance (e.g., "You need to put your elbow higher" in shot put), but is also related to the self-concept and self-assessments of an individual (e.g., "You scored really low in this fitness test"). Such feedback can be in line with what the individual thinks of himself (consistent feedback), but it can also be inconsistent with the individual's self-assessment (in both a positive and a negative direction). How such (in-)consistent information is processed in memory has been a fiercely debated topic in self-concept psychology since at least the 1960s. Two basic theoretical models try to explain the underlying information

processing mechanisms: self-enhancement and self-consistency theories.

Self-enhancement theories and self-consistency theories

Dating back to Allport (1937), the general idea of *self-enhancement theories* is that people seek positive feedback to maintain or enhance a positive image of themselves, or, as Swann, Pelham, and Krull (1989) put it, "people strive systematically to promote the perception that others think well of them" (p. 782). Different information processing strategies can be subsumed under the self-enhancement motive, for example self-serving attributions (e.g., Campbell & Sedikides, 1999; De Michele, Gansneder, & Solomon, 1998), the (involuntary) strategic choice of social comparison targets (e.g., downward comparisons; Suls & Wills, 1991), self-concept immunization (Greve & Wentura, 2003), or behavioral self-handicapping (e.g., the creation or claim of obstacles in anticipation of failure; Jones & Berglas, 1978).

The idea of *self-consistency theories* can be traced back to Festinger's (1954) theory of cognitive dissonance and has been

* Corresponding author. Present address: Goethe University Frankfurt am Main, Institute of Sport Sciences, Ginnheimer Landstraße 39, 60487 Frankfurt am Main, Germany. Tel.: +49 69 798 24558.
E-mail addresses: ennigkeit@sport.uni-frankfurt.de (F. Ennigkeit), haensel@sport.tu-darmstadt.de (F. Hänsel).

adopted in Swann's (1983) self-verification theory. The general idea is that people strive for a consistent self-concept, that is, they prefer to process information that confirms their own self-views, even if this information is negative in nature. Proponents of this theory assume that the self-concept guides both cognition and action of individuals and therefore provides a sense of coherence which people want to maintain. A consistent self-concept allows for a stable view of the world and makes people predictable to one another.

Although self-enhancement and self-consistency theories make different predictions regarding the acceptance of enhancing (i.e., positive) and confirmative (i.e., consistent) feedback, there is a great deal of empirical evidence supporting both theories, "with some studies favoring self-consistency theory and others favoring self-enhancement theory" (Swann, Griffin, Predmore, & Gaines, 1987, p. 882; see also Jones, 1973). Shrauger (1975) found that the observed *type of reaction* to self-relevant feedback moderates whether self-enhancement or self-consistency principles guide information processing: *Affective* reactions (e.g., the satisfaction with feedback) follow the predictions of self-enhancement theories (i.e., people affectively prefer positive to consistent feedback), while *cognitively* (e.g., the credibility of feedback), people rather react in line with predictions of self-consistency theories (i.e., people cognitively prefer consistent to positive feedback). The results of a recent meta-analysis by Kwang and Swann (2010) confirm this finding. The authors conclude that "the evidence suggests that both motives are potent but that they express themselves differently depending on the response class [i.e., type of reaction] under scrutiny as well as the relevance of other motivational forces" (p. 274).

The role of self-schemas

Petersen and colleagues (Dauenheimer, Stahlberg, & Petersen, 1999; Petersen, 1994; Petersen, Stahlberg, & Dauenheimer, 2000; Stahlberg, Petersen, & Dauenheimer, 1999) introduced another variable assumed to moderate information processing: self-schemas. In their *integrative self-schema model* (ISSM), they assume that on top of the type of reaction (affective vs. cognitive), the existence of a self-schema in the area in which feedback is given moderates whether the processing of the feedback follows self-enhancement or self-consistency principles.

Schema theory in social cognition research reaches back to the 1970s and assumes that social and self-related knowledge is organized in general cognitive structures. Those schemas facilitate information processing by affecting encoding, memory as well as inference and evaluation of information (Fiske & Taylor, 1991). The transfer of schema theory to self-concept research is usually connected to Hazel Markus (1977). She assumed that people are regularly confronted with self-relevant information which they process actively and constructively. To organize, categorize and explain this information cognitively, people develop representations about themselves (self-schemas) that Markus defines as "cognitive generalizations about the self, derived from past experience, that organize and guide the processing of self-related information contained in the individual's social experiences" (p. 64). According to Markus, people are schematic on a certain self-aspect when they rate attributes connected to this self-aspect (e.g., adjectives) as *very self-descriptive* and at the same time as *very important* to the image they have of themselves. Self-schemas can be developed in aspects as different as personality traits (e.g., spontaneity) or areas of life (e.g., profession, family). People without a self-schema in a certain self-aspect are called *aschematic*. An individual's self-concept is then seen, in this perspective, as a system of differently elaborated self-schemas (e.g., Markus & Sentis, 1982). Markus (1977) found that people who are schematic on independence reacted faster to adjectives connected to this

personality trait than people who were aschematic on this self-aspect. Besides, unlike aschematics, they rejected feedback inconsistent to their self-assessment (i.e., telling people schematic on independence that they are easily suggestible).

One important characteristic of self-schemas is that they are assumed to be *resistant to change*: "Many of the information-processing advantages of schemas would be lost if schemas changed at each encounter with slightly discrepant information" (Fiske & Taylor, 1991, p. 152). Petersen et al. (2000) defined this resistance to change as the extent of connections they have with other cognitions. They found empirical evidence for both the higher number of cognitive connections and the higher stability of well-elaborated self-schemas compared to aschematic self-aspects. The authors base the predictions of their ISSM on this very characteristic of self-schemas: In *schematic self-aspects*, consistent feedback can easily be integrated, whereas inconsistent feedback (whether positive or negative) leads to cognitive inconsistencies. People therefore are expected to react in line with *consistency theories* in these self-aspects. *Aschematic self-aspects*, on the other hand, are linked less to other cognitions. Therefore, people have less of a problem integrating inconsistent, but positive feedback into their self-view and are expected to use this opportunity for *self-enhancement* in these self-aspects.

In a series of studies (e.g., Dauenheimer et al., 1999; Petersen et al., 2000; Stahlberg et al., 1999) the authors found empirical support for the predictions of the ISSM, notably for personality traits such as spontaneity, considerateness, masculinity, or achievement orientation. They provided participants with bogus feedback after they had them complete a computer-assisted test and measured both affective (spontaneous emotions, satisfaction) and cognitive reactions (accuracy of feedback, agreement of feedback with the assessments by well-acquainted others). In general, results show that for *affective reactions*, self-enhancement principles dominate in aschematic self-aspects (as expected), whereas no clear preference for consistent or positive feedback can be found in schematic self-aspects. The authors attribute the latter result to the simultaneous impact of self-enhancement (because of the affective reaction) and self-consistency principles (because of the self-schema). Likewise, for *cognitive reactions*, self-consistency principles predict reactions in schematic self-aspects (as expected), whereas no clear preference for consistent or positive feedback can be found in aschematic self-aspects. The latter result is ascribed to the simultaneous impact of self-consistency (because of the cognitive reaction) and self-enhancement principles (because no self-schema is present).

Contrary to the research on ISSM so far, in the present study, we will not consider self-schemas in personality traits, but a global self-schema in the fields of exercise: the exercise self-schema.

Exercise self-schema

Deborah Kendzierski (1988, 1990) adapted the self-schema concept to sport and exercise psychology. She established the term of an *exercise self-schema* which refers to cognitive generalizations about the self that are based on "an individual's experiences associated with exercise, such as thoughts, feelings, and motor and autonomic responses to exercise" (Sabiston, Whitehead, & Eklund, 2012, p. 231). Kendzierski (1994) however emphasizes that an exercise self-schema is more than the sum of experiences in that area, because an individual needs to attach importance to this self-aspect as well. She developed a short questionnaire to measure exercise self-schema (Kendzierski, 1988; see Method section). Subsequently, other researchers conducted studies using the construct, with most of them exploring the influence of exercise self-schema on exercise behavior, or on exercise-related cognitions.

Specifically, some studies found that exercise self-schema moderates the intention-behavior-gap in exercise (Banting, Dimmock, & Lay, 2009; Estabrooks & Courneya, 1997; Sheeran & Abraham, 2003; Sheeran & Orbell, 2000). Concerning information processing, Kendzierski (1990) was able to reproduce Markus' (1977) finding that exercise schematics were faster to judge exercise-related stimuli as self-descriptive compared to people without exercise self-schema. Berry (2006) additionally demonstrated that exercise schematics show an attentional bias for exercise-stimuli in a Stroop test. To our knowledge, the moderating role of exercise self-schema in the processing of self-relevant feedback has not been examined to date.

The aim of this study is to test the predictions of the ISSM in the fields of sport and exercise. We hypothesize that exercise self-schema influences cognitive and affective reactions to self-relevant feedback in this domain. For the *affective reaction*, participants without exercise self-schema are expected to prefer positive feedback to consistent feedback (self-enhancement principle), whereas exercise schematics should show no clear preference for either consistent or positive feedback. The latter prediction is the result of the simultaneous impact of self-enhancement (because of the affective reaction) and self-consistency principles (because of the self-schema). For the *cognitive reaction*, exercise schematics are expected to prefer consistent feedback to positive feedback (self-consistency principle), whereas participants without exercise self-schema should show no preference for either type of feedback. The latter prediction results from the simultaneous impact of self-consistency (because of the cognitive reaction) and self-enhancement principles (because no self-schema is present).

Method

Overview

The online experiment, which was conducted in German language, consisted of a 2 (Exercise Self-Schema [yes vs. no]) × 3 (Type of Feedback [consistent vs. positive vs. negative]) mixed model design (between-subject factor: exercise self-schema, within-subject factor: type of feedback) with affective and cognitive reactions as dependent variables. We followed recommendations for successful online research given by Reips (e.g., 2002, 2007).

The general idea of the experiment was based on the method used in studies on the ISSM (e.g., Petersen et al., 2000): In a cover story, participants were told that they were to take part in a study evaluating the subjective acceptance of a newly developed test measuring six aspects related to exercise. Exercise self-schema was measured using the scale by Kendzierski (1988). After completion of the alleged test, participants were provided with bogus feedback generated from their own self-assessments. Each participant was given feedback consistent with his own self-assessment as well as feedback deviating positively and negatively from his self-assessment. Affective and cognitive reactions to each piece of feedback were assessed afterward.

Sample

472 German adults (248 women, 224 men) between 17 and 71 years of age ($M_{age} = 31.35$, $SD = 11.90$) participated. 44.5% of the sample held a university degree, 14.4% had a noncollegiate vocational qualification, and the remaining of the sample did not complete professional qualification (yet). For their current occupation, university students (44.7%) and gainfully employed participants (44.5%) comprised the majority of the sample.

We recruited the participants passively, for example, via social networks, forums, mailing lists, homepages, and notices posted on campus. The only recruitment criterion was a minimum age of 16

years. Participants were invited to take part in a drawing for gift certificates (10×20 €) after completion of the experiment. All participants agreed to informed consent at the beginning.

To ensure a high data quality, we excluded participants from the original sample ($n = 631$) who (a) did not complete the experiment, (b) objected to their data being used after the debriefing, (c) were exceptionally quick to complete the experiment ($M < 15$ min with $M = 33.31$ min, $SD = 30.60$), or (d) showed conspicuous response patterns on one or more pages (e.g., always using the option on the far right). Furthermore, we excluded participants who made an at least roughly legitimate guess about the underlying hypotheses of the study to avoid bias. This applied to nine participants only, indicating that the cover story was generally well accepted by the sample.

Procedure and instruments

The experiment consisted of eight parts: (1) presentation of cover-story and agreement to informed consent, (2) measurement of sociodemographic traits, (3) measurement of exercise-self-schema, (4) measurement of self-assessments in six aspects related to exercise, (5) work on alleged newly developed test consisting of questionnaire items and reaction tests, (6) presentation of bogus feedback generated from self-assessments (see step 4), (7) measurement of affective and cognitive reactions to each piece of feedback, and (8) detailed debriefing. The procedure was approved by the university's ethical commission. We conducted multiple pretests to examine the credibility of both the cover story and the feedback generated from the alleged test as well as the comprehensibility of instructions and items. Following is a more detailed description of the procedure and the instruments used for operationalization of the variables in the respective steps.

Cover story and sociodemographic traits

Participants expected to take part in a study evaluating the subjective acceptance of a newly developed test measuring aspects of fitness, health, and physical attractiveness. The cover story explained that the test had already been validated and that the results of the test were highly correlated with data collected in objective tests (e.g., fitness tests, to make sure the credibility of the test wasn't doubted). After participants agreed to informed consent, we collected some basic sociodemographic traits.

Exercise self-schema

We assessed exercise self-schema using Kendzierski's (1988, 1990) exercise self-schema measure. Participants were asked to indicate, on 11-point Likert-type scales (labeled at the extremes: $1 = $ *not at all self-descriptive*, $11 = $ *very self-descriptive*), to what extent the phrases "someone who exercises regularly", "someone who keeps in shape", and "someone who is physically active" describe them. The items were included in a set of twelve filler items such as "someone who is spontaneous", "someone who reads books regularly" to avoid bias. In a second step, subjects indicated how important ($1 = $ *not at all important* to $11 = $ *very important*) the same three descriptor and twelve filler phrases are to the image they have of themselves, regardless of whether or not the phrase describes them. Participants who rated at least two of the three items as extremely self-descriptive (8–11 points) and at the same time as extremely important to their self-image (8–11 points) were classified as *exercise schematics*. Deviating from Kendzierski's original classification system (schematics, aschematics, non-schematics, and unclassified participants)—that leaves large parts of the sample unclassified (e.g., more than 45% in Yin & Boyd, 2000)—we categorized the remaining participants as *not having an exercise self-schema*, following the procedure by Sheeran and Orbell (2000) and Kendzierski, Sheffield, and Morganstein (2002).

Self-assessments

Participants rated themselves in six aspects related to exercise, namely physical fitness, sportiness, physical resilience, health, physical well-being, and physical attractiveness. We described each aspect briefly with two or three sentences. The order of the presented aspects was randomized equally across people with and without exercise self-schema. Participants evaluated themselves using a slider labeled "1" on the left- and "100" on the right-hand side, resulting in a point value (from 1 to 100) for each of the six aspects (the exact point value not being visible to the participants).

Alleged test

Participants then started the alleged newly developed test beginning with various questions about health and exercise behavior (e.g., "Do you smoke?", "How many hours do you exercise on average per week?"). 36 additional questionnaire items covering the six aspects of the test (physical fitness, sportiness, physical resilience, health, physical well-being, and physical attractiveness) followed. They were partly self-developed, partly taken from standardized questionnaires (e.g., the Physical Self-Description Questionnaire; Marsh & Redmayne, 1994). After twelve of the 36 items, participants worked on a reaction test in the style of an implicit association test (categories: activity/inactivity, me/not me; 18 attributes, 5 tasks). After the next twelve items, they worked on a reaction test in the style of an emotional Stroop test (29 stimuli that were presented twice, 4 colors), before the last twelve items were presented. Participants thought the feedback given afterward was based on this part of the experiment, but in fact it served no diagnostic purpose. The reaction tests were included (a) to reduce monotony while working on the experiment and (b) to boost the plausibility of the (alleged) test's feedback.

Type of feedback

Participants were then told that they would now get feedback in all six aspects based on their responses and reaction times in the (alleged) test and were reminded that they would be asked questions following each feedback so that we could study their subjective acceptance of the test. We provided participants with six pieces of feedback two of which were consistent with their self-assessments, two deviated positively, and two deviated negatively. Contrary to what participants were told, this bogus feedback was based on their own self-assessments only (see above). Each piece of feedback was given as follows: "You have reached x points of 100 points possible for [e.g.] 'physical well-being'". In the *consistent* condition, the point value (x) deviated only minimally from the participants' self-assessment (± 3 points). For *positive* feedback, 23 points were added and for *negative* feedback, 23 points were subtracted from their self-assessment. The choice of a 23-point difference was based on a pilot study by Stahlberg et al. (1999). The point value ranged from 1 to 100 and could not exceed the end of the scale, so that for some participants who rated themselves very positively or negatively in some or all aspects, the difference was lower than 23 points in these aspects. The assignment of the type of feedback to the six aspects and the order of feedback presentation was randomized equally across people with and without exercise self-schema. Reactions to the two associated consistent, positive and negative pieces of feedback were then averaged to obtain three levels (consistent, positive, negative) of the within-subject factor 'type of feedback'.

Affective and cognitive reactions

After each presentation of feedback, participants were asked how much this feedback coincided with their own expectations on a 10-point Likert-type scale (manipulation check; 1 = *worse than expected*, 10 = *better than expected*). The answers for both associated

pieces of feedback were averaged. We then assessed affective and cognitive reaction by two items each, following the procedure by Petersen et al. (2000) and Dauenheimer et al. (1999). After each feedback, for the *affective reaction*, participants were asked to rate a) which spontaneous emotion this feedback aroused and b) how satisfied they were with this feedback on 10-point Likert-type scales with labeled extremes (1 = *very negative emotions* to 10 = *very positive emotions* and 1 = *not at all satisfied* to 10 = *very satisfied*, respectively). For the *cognitive reaction*, participants rated a) how accurately they felt this feedback assessed them (1 = *not very well at all* and 10 = *very well*) and b) how well assessments by well-acquainted others would agree with this feedback (1 = *would agree very well* and 10 = *would not agree at all*, respectively). We used the average of the two items each for both affective and cognitive reaction. Previous research suggests that affective and cognitive reactions can be considered independent variables (e.g., Dauenheimer, 1996; Dauenheimer et al., 1999). Besides, because of the special data patterns predicted for each dependent variable, we performed hypotheses testing separately for both types of reactions.

Debriefing

After completion of the experiment, participants were fully debriefed about the purpose of the study, its variables, and its expected findings. We especially emphasized the fictitious character of the provided feedback and explained why we needed to leave them in the dark about the actual aim of the study.

Results

Preliminary analysis

Exercise self-schema

Participants were classified as either having an exercise self-schema ($n = 263$) or not having an exercise self-schema ($n = 209$) according to the procedure described above. No differences were found between people with and without exercise self-schema in terms of sociodemographic traits such as sex, $\chi^2 (1) = .35$, $p = .554$, age, $t (470) = .14$, $p = .888$, professional qualification, $\chi^2 (6) = 7.49$, $p = .278$, or current occupation, $\chi^2 (2) = 2.06$, $p = .358$.

Manipulation check for type of feedback

After the presentation of each feedback, participants were asked how much this result coincided with their expectations to check the success of the manipulation. Descriptive statistics show the expected results: Consistent feedback, $M = 5.93$, $SD = 1.58$, coincides better with the sample's expectations than positive, $M = 8.01$, $SD = 1.41$, or negative feedback, $M = 3.66$, $SD = 1.59$. A repeated measures ANOVA confirms the differences of mean values, $F(1.94, 915.82) = 1212.57$, $p < .001$, $\eta_p^2 = .72$. Pairwise comparisons using Bonferroni adjustment show that all three conditions differ significantly from each other, $p < .001$. The manipulation of the type of feedback can therefore be considered successful and we used the whole sample for hypotheses testing, even though the 23-point-difference referring to the self-assessments could not be realized in all cases (because some participants used self-assessments higher than 77 and lower than 24 points, but feedback was limited to a scale from 1 to 100 points).[1]

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[1] We repeated hypotheses testing twice, (a) including only those participants for whom manipulation was completely successful (i.e., participants who never rated themselves higher than 77 or lower than 24 points in any aspect), and (b) including only those whose feedback could be manipulated by at least a 12-point-difference (i.e., those who never rated themselves higher than 88 or lower than 13 in any aspect). In both cases, the results qualitatively remained the same.

Affective reaction

Descriptive statistics for affective reaction can be found in Table 1. The ANOVA for the affective reaction revealed an unexpected significant main effect for the between-subject factor exercise self-schema, $F(1, 470) = 62.84$, $p < .001$, $\eta_p^2 = .12$. Exercise schematics ($M = 6.63, SD = 1.27$) affectively reacted more positively than people without exercise self-schema ($M = 5.56, SD = 1.41$), regardless of type of feedback.

We also found an expected significant main effect for the within-subject factor type of feedback, $F(2, 940) = 954.58$, $p < .001$, $\eta_p^2 = .67$, indicating that all participants reacted more positively to positive feedback ($M = 8.08, SD = 1.70$) than to consistent feedback ($M = 6.48, SD = 2.12$; $F(1, 470) = 293.31$, $p < .001$, $\eta_p^2 = .38$) and more positively to consistent than to negative feedback ($M = 4.02$, $SD = 1.66$; $F(1, 470) = 679.40$, $p < .001$, $\eta_p^2 = .59$).

Finally, the hypothesized interaction between exercise self-schema and type of feedback was significant as well, $F(2, 940) = 9.42$, $p < .001$, $\eta_p^2 = .02$, indicating that people with and without exercise self-schema differ in their affective reaction to positive, consistent and negative feedback. To break down this effect, we conducted contrasts to compare the level *consistent* of type of feedback to the levels *positive* and *negative* between participants with and without exercise self-schema. These contrasts first show a significant interaction for the comparison of negative and consistent feedback, $F(1, 470) = 17.41$, $p < .001$, $\eta_p^2 = .04$. Means suggest that this ordinal interaction is due to the fact that the more positive reaction to consistent feedback compared to negative feedback is more pronounced for participants with exercise self-schema than for those without, i.e., the mean difference between the reactions to consistent and negative feedback is smaller for people without exercise self-schema (see Fig. 1). Second, the interaction between exercise self-schema and the comparison of positive and consistent feedback, as formulated in the hypothesis, yields no significant effect ($F(1, 470) = 1.01$, $p = .315$). Participants with and without exercise self-schema affectively prefer positive to consistent feedback in equal measure. Therefore, the first hypothesis cannot be confirmed.

These results remained qualitatively the same when considering age as a covariate. Gender specific analyses yielded no different results either.

Cognitive reaction

Descriptive statistics for cognitive reaction can be found in Table 1. Just as for the affective reaction, the ANOVA for the cognitive reaction revealed an unexpected significant main effect for the between-subject factor exercise self-schema, $F(1, 470) = 6.57$, $p = .011$, $\eta_p^2 = .01$. Exercise schematics ($M = 6.56$, $SD = 1.22$) considered the feedback more accurate than people without exercise self-schema ($M = 6.28$, $SD = 1.15$), regardless of type of feedback.

We also found the expected significant main effect for the within-subject factor type of feedback, $F(1.93, 904.78) = 462.96$, $p < .001$, $\eta_p^2 = .47$, indicating that all participants felt that positive feedback was a more accurate assessment of them ($M = 7.49$, $SD = 1.46$) than consistent feedback ($M = 7.06$, $SD = 1.72$; $F(1, 470) = 24.79$, $p < .001$, $\eta_p^2 = .05$), and consistent feedback was more accurate than negative feedback ($M = 4.75$, $SD = 1.88$; $F(1, 470) = 520.42$, $p < .001$, $\eta_p^2 = .53$).

Finally, we found a significant interaction effect for the hypothesized interaction between exercise self-schema and type of feedback, $F(1.93, 904.78) = 18.73$, $p < .001$, $\eta_p^2 = .04$, indicating that people with and without exercise self-schema differ in their cognitive reaction to positive, consistent and negative feedback. To

Table 1
Descriptive statistics for affective and cognitive reactions depending on exercise self-schema and type of feedback ($N = 472$).

Exercise self-schema[a]	Type of feedback	M[b]	SD
Affective reaction			
Yes	Positive	8.58	1.43
No		7.46	1.81
Total		8.08	1.70
Yes	Consistent	7.05	2.01
No		5.75	2.03
Total		6.48	2.12
Yes	Negative	4.25	1.66
No		3.72	1.62
Total		4.02	1.66
Cognitive reaction			
Yes	Positive	7.80	1.39
No		7.10	1.45
Total		7.49	1.46
Yes	Consistent	7.29	1.80
No		6.77	1.56
Total		7.06	1.72
Yes	Negative	4.59	1.89
No		4.96	1.85
Total		4.75	1.88

[a] Of the $N = 472$ participants, $n = 263$ were classified as having an exercise self-schema, and the remaining $n = 209$ were classified as not having an exercise self-schema.
[b] For the means, scales range from $1 = $ *negative reaction* to $10 = $ *positive reaction*.

break down this effect, we conducted contrasts to compare the level *consistent* of type of feedback to the levels *positive* and *negative* between participants with and without exercise self-schema. Just as for the affective reaction, these contrasts first show a significant interaction for the comparison of negative and consistent feedback, $F(1, 470) = 20.93$, $p < .001$, $\eta_p^2 = .04$. Means suggest that this ordinal interaction is due to the fact that preference for consistent feedback compared to negative feedback is more pronounced for participants with exercise self-schema than for those without, i.e., the mean difference between the reactions to consistent and negative feedback is smaller for people without exercise self-schema (see Fig. 2). Second, the interaction between exercise self-schema and the comparison of positive and consistent feedback, as formulated in the hypothesis, yields no significant effect, $F(1, 470) = 1.05$, $p = .306$. Participants with and without exercise self-schema cognitively prefer positive to consistent feedback in equal measure. Therefore, the second hypothesis cannot be confirmed either.
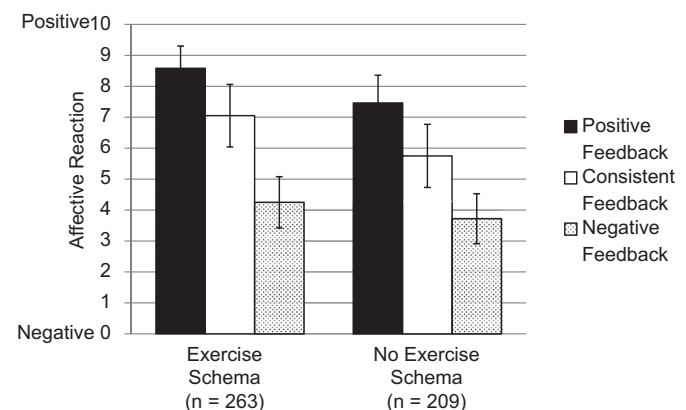

Fig. 1. Effect of exercise self-schema and type of feedback on affective reaction. Pictured are means and standard deviations ($N = 472$).

The results remained qualitatively the same when considering age as a covariate. Gender specific analyses yielded no different results either, the only exception being the main effect of exercise self-schema: The fact that exercise schematics reacted more positively than people without exercise self-schema, regardless of type of feedback, seems to be valid only for females, $F(1, 246) = 3.87$, $p = .049$, $\eta_p^2 = .02$, not for males, $F(1, 222) = 2.62$, $p = .11$.

Discussion

The purpose of the current study was to test whether exercise self-schema influences affective and cognitive reactions to self-relevant feedback related to exercise. Such feedback can be processed in terms of self-enhancement or in terms of self-consistency theories. Based on the ISSM, the exercise self-schema (a cognitive generalization about the self in the fields of sports and exercise) was introduced as a variable moderating the type of information processing. People schematic for exercise were expected to cognitively prefer feedback consistent with their own self-assessments. For people without exercise self-schema, an affective preference for feedback deviating positively from their own self-assessments was predicted. To our knowledge, this study is the first to examine the influence of the exercise self-schema on reactions to self-relevant feedback in the sports and exercise domain.

First of all, the hypotheses derived from the ISSM could not be confirmed with the present data. Instead, participants affectively and cognitively preferred feedback that deviated positively from their own self-assessment, regardless of exercise self-schema, and therefore reacted in line with the predictions of self-enhancement theories. Interestingly, a significant interaction was found between reactions to consistent and negative feedback: For both affective and cognitive reaction, the mean difference between the reactions to consistent and negative feedback was smaller for participants not having an exercise self-schema than for people schematic for exercise. We did not find the predicted interaction between exercise self-schema and reactions to consistent and positive feedback. This conflicts with earlier findings by Petersen and colleagues (e.g., Dauenheimer et al., 1999; Petersen et al., 2000; Stahlberg et al., 1999) who found that self-schemas moderate whether information processing follows self-enhancement or self-consistency principles, as predicted by the ISSA. A possible explanation for our unexpected result could be the nature of the self-aspects feedback was given for in our study: For all six aspects in question, higher values are automatically associated with a more

positive evaluation. For example, most people would probably agree that it is nicer to score as high as possible in a test measuring physical fitness or health. However, for many of the personality traits tested in the ISSA studies, the same does not hold true. A maximum score in a test measuring spontaneity may not be seen as purely positive, because being too spontaneous can be hindering in many situations. Stahlberg, Petersen, and Dauenheimer (1997) assume that in self-aspects in which obtaining a maximum score is desirable (which often seem to be aspects related to performance), the self-enhancement motive is generally more dominant than the self-consistency motive. Furthermore, Stahlberg et al. (1999) suggest that consistent feedback might at the same time be perceived as positive feedback, especially in schematic self-aspects in which self-evaluations are positive per se. This could explain why no significant differences between the reactions to positive and consistent feedback could be found, although it does not explain the fact that the same holds true for people without exercise schema as well. However, self-assessments in all six aspects were very positive for all participants in general, the lowest mean being $M = 66.92$ ($SD = 25.20$) for physical fitness. As stated by Kwang and Swann (2010), in unselected samples roughly 70% will possess positive self-views, which means that "evidence of 'self-enhancement' in such samples may reflect self-verification strivings of the majority of people who happen to have positive self-views" (p. 275).

We also found unexpected main effects for exercise self-schema (both for the affective and the cognitive reaction) which seem noteworthy as well. Regardless of type of feedback, participants schematic for exercise reacted more positively to the feedback, both affectively and cognitively, than people without exercise self-schema. Given the operationalization of exercise self-schema, it appears that people who judge exercise phrases as highly self-descriptive and highly important for their self-image are more prone to react emotionally stronger to feedback and to accept feedback in the exercise domain in general. The question remains whether this result could be attributed to the importance aspect of the self-schema operationalization only, as Sheeran and Orbell (2000) suggest. People show an increased attentional focus and higher cognitive investment for self-aspects deemed important than for aspects less central to their self. They are also assumed to react more intensely when important self-aspects are involved (Thomas, 1989).

Finally, we found an unexpected interaction between exercise self-schema and the levels *consistent* and *negative* of type of feedback. For both affective and cognitive reaction, the mean difference between the reactions to consistent and negative feedback was smaller for people without exercise self-schema than for those with exercise self-schema. No predictions were made regarding the reaction to negative feedback beforehand, but the result could be interpreted in terms of self-consistency principles: Exercise schematics devalued negative feedback more, relative to consistent feedback, than people without exercise self-schema. This bigger mean difference could be the result of a protective mechanism indicating that exercise schematics do, in fact, prefer consistent feedback more than people without such a self-schema. However, this manifested itself not in different reactions to positive and consistent, but to consistent and negative feedback. The derogation of negative feedback has been a matter discussed in the literature before, however, mostly as a strategy to self-enhance (e.g., Greenberg, Pyszczynski, & Solomon, 1982). Research also shows a memory bias for non-threatening information: Negative feedback is less easily recalled than positive feedback in order to protect the self (mnemic neglect model; Pinter, Green, Sedikides, & Gregg, 2011; Sedikides & Green, 2004). Interestingly, this self-protective mechanism occurs especially for central (i.e., important) self-aspects (Green, Pinter, & Sedikides, 2005). Because exercise
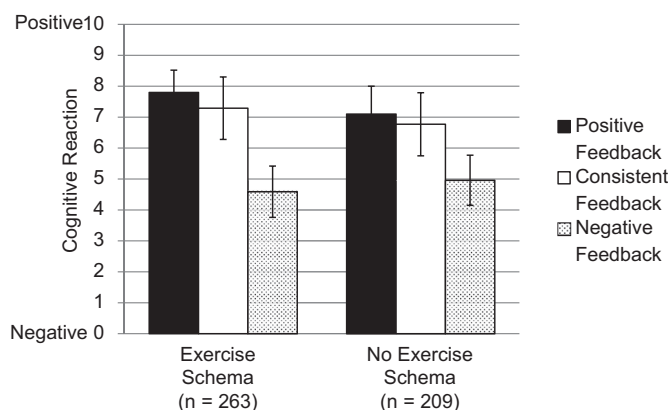

Fig. 2. Effect of exercise self-schema and type of feedback on cognitive reaction. Pictured are means and standard deviations ($N = 472$).

schematics see exercise-related attributes as highly descriptive and as important for their self, it is well possible that our results indicate a self-protective mechanism that is more pronounced for exercise schematics who derogate negative feedback more in relation to consistent feedback than people without exercise self-schema.

Self-schema has shown to moderate whether self-enhancement or self-consistency principles dominate information processing. However, other variables moderating this relationship discussed in the literature include the motivation to change one's self-assessments (Dauenheimer, 1996; Green, Sedikides, Pinter, & Van Tongeren, 2009), cognitive resources (Swann & Schroeder, 1995), the participant's certainty of his own self-assessment (Pelham & Swann, 1994), and, when relationship quality is discussed, the perceived risk of rejection (Kwang & Swann, 2010). It could be enlightening to examine whether the addition of one of these variables in future studies changes the results presented in this paper. Especially the certainty of one's own self-assessment seems to be closely connected to the self-descriptiveness and the importance of this self-aspect.

We are well aware of the methodological limitations of the present study that—in large part—are due to the operationalization of the variables used. Participants' above-average self-assessments in the six self-aspects resulted in problems with successful manipulation of the positive feedback condition for large parts of the sample. Although we took this problem into consideration during statistical analyses (see Footnote 1), it should be resolved in future studies, for example by altering the anchors of the slider used for self-assessment (e.g., use "professional athlete" instead of "100" on the right end of the slider). Furthermore, we adopted the 23-point-difference found in the pilot study by Stahlberg et al. (1999) for feedback manipulation, but didn't actually verify its adequateness in the context of the present study.

We based operationalization of the dependent variables on the studies by Petersen et al. (2000), but of course, alternatives for measuring affective and cognitive reaction should be taken into account. In future research, the use of standardized questionnaires (e.g., the short form of the Positive and Negative Affect Schedule; Thomson, 2007) is conceivable, which could ideally be combined with the assessment of physiological characteristics. For the cognitive reaction, alternative operationalization is possible as well (e.g., using attributions).

The measurement of exercise self-schema could also be addressed. One problem with the exercise self-schema scale is the unbalanced distribution of the sample in schematic, aschematic, non-schematic, and unclassified participants. We tried to tackle the problem by combining all participants not schematic for exercise in one group, but of course this approach deviates from the original procedure proposed by Markus (1977). Besides, Burke, Kraut, and Dworkin (1984) found that instruments measuring self-schemas lack discriminant validity compared to instruments that measure just extremity (i.e., self-descriptiveness) of the same self-aspect. Although stemming from another theoretical viewpoint,[2] it might be promising to look into instruments measuring the extent to which people identify with exercise/being an athlete, e.g., the Exercise Identity Scale (Anderson & Cychosz, 1994), the Athletic Identity Measurement Scale (Brewer, Van Raalte, & Linder, 1993), or

the Athletic Identity Questionnaire (Anderson, 2004). Such instruments assess conceptually similar constructs and could be analyzed as continuous variables in future studies.

As far as we are aware, this study is the first to test the influence of a structural aspect of the self, namely the exercise self-schema, on the reactions to self-relevant feedback in the fields of sport and exercise. How people process feedback is an important aspect in both elite sports and exercise. The acceptance of feedback given by the coach or the instructor, respectively, could influence motivation and willingness for exertion. Feedback research in sport and exercise psychology has focused mainly on technical feedback in order to improve motor performance. For example, the effects of mode (e.g. visual, verbal), timing, or frequency of feedback on motor performance have been examined (e.g., Schmidt & Wrisberg, 2007; Goh, Kantak, & Sullivan, 2012). Little attention has been given to how feedback deviating from an individual's self-assessment is processed depending on person characteristics. Although our data suggest a general dominance of the self-enhancement motive when processing self-relevant information, the found larger gap between reactions to consistent and negative feedback for exercise schematics (in relation to participants without exercise schema) should be examined further. In future studies, the processing of negative feedback should be included in hypothesis testing from the beginning. Perhaps the focus should shift from testing differences in the reactions to positive and consistent feedback to investigating those to consistent and negative feedback. This could lead to practical consequences for giving feedback depending on whether the person receiving the feedback sees himself as an exerciser (i.e., is schematic for exercise) or not.

A replication of the present study in a laboratory situation (i.e., under controlled conditions) should exclude the possibility that the data collection mode (i.e., the online experiment) influenced the participants' reactions. In addition, the experiment should be transferred to a practical setting, where participants shouldn't receive a point value only, but individual feedback that could be, for example, based on a fitness test they do in the gym. Such a setting would enhance the importance and the credibility of the feedback to the participants and could test reactions to feedback in a real exercise situation.

In summary, the present study considers self-schema as a variable moderating information processing in the sport and exercise domain for the first time. First, the results highlight a dominance of the self-enhancement motive in this domain, as all participants affectively and cognitively preferred positive over consistent feedback. Second, exercise self-schema interacted with the reactions to consistent and negative feedback, in that exercise schematics seem to devalue negative feedback more than people without exercise self-schema. Finally, the present study presents a new approach by integrating a structural aspect of the self in feedback research that could be employed in future studies to generate valuable insights expanding further our knowledge and understanding in this complex area of research.

Acknowledgments

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.psychsport.2013.10.008.

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[2] The idea of identity theory (e.g., Burke & Stets, 2009) is conceptually very similar to the idea of self-consistency theories (especially self-verification theory). Person identities are meanings that define a person as a unique individual. Among other things, identity theory assumes that people desire to verify who they are, even if the identities in question are negative. The theory also suggests that the rate at which identities change is very slow and thus seems to support the idea of schema theory: Self-schemas are expected to be relatively resistant to change as well. Identity theory therefore offers further support for the predictions of the ISSA. Linking the findings of self-verification theory with those of identity theory in the future could be beneficial for both sides.

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Appendix C: Publication 3

Ennigkeit, F., Hänsel, F., & Heim, C. (2018). Does exercise identity moderate affective and cognitive reactions to feedback on physical fitness? *Psychology of Sport and Exercise, 37*, **10–18. doi:10.1016/j.psychsport.2018.03.008**
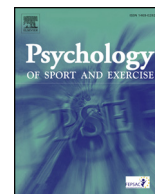
Does exercise identity moderate affective and cognitive reactions to feedback on physical fitness?

Fabienne Ennigkeit[a,*], Frank Hänsel[b], Christopher Heim[a]

[a] Department of Sports Sciences, Goethe University Frankfurt am Main, Germany
[b] Institute of Sport Science, Technical University Darmstadt, Germany

ABSTRACT

Objectives: The aim of this study was to examine the moderating role of exercise identity on the processing of feedback on self-relevant physical fitness. It was hypothesized that individuals with a strong exercise identity would react cognitively more positively to consistent feedback than to positive feedback (self-consistency principle), whereas individuals with a weak exercise identity were expected to react affectively more positively to positive feedback than to consistent feedback (self-enhancement principle).
Design: Cross-sectional.
Method: 215 university students (64.2% male, M_{age} = 23.82 years, SD = 2.32) were given bogus feedback on their results on an alleged fitness test based on heart rate variability in a laboratory setting. Affective and cognitive reactions were assessed afterwards. Data were examined using moderated regression analyses.
Results: Exercise identity did not moderate affective reaction. For cognitive reaction, an interaction contrary to expectations was found: Individuals with a very weak exercise identity reacted more positively to consistent feedback than to positive feedback. Further, individuals with a strong exercise identity reacted more negatively to negative feedback than to consistent feedback.
Conclusions: The hypotheses could not be confirmed. Cognitive reaction to negative feedback became more negative with a stronger exercise identity, whereas consistent feedback was received more positively as the strength of exercise identity increased. In future research focus should be on integrating the processing of negative feedback on a theoretical basis and should involve investigation into other relevant moderating variables.

1. Introduction

In many situations involving exercise or sport, individuals are confronted with feedback relevant to their self-image. For example, they might receive the result of a physical fitness test suggesting they did better than they expected, or an instructor in a group exercise class might tell them that endurance is not their strong point although they thought it was. As shown in the examples, such feedback can deviate in a positive or negative direction from one's own self-assessment, but it also can be consistent with one's self-assessment.

Studies have shown that positive feedback can enhance intrinsic motivation and motor learning (e.g., Mouratidis, Vansteenkiste, Lens, & Sideridis, 2008; Whitehead & Corbin, 1991; Ávila, Chiviacowsky, Wulf, & Lewthwaite, 2012) but research on how such feedback is actually processed by individuals is scarce. In general, the processing of self-relevant feedback can be explained by a number of theories, the most prominent being self-enhancement theory and self-consistency theory. The aim of the present study was to investigate whether one's view of

oneself in terms of the self-as-exerciser (Mullen, 2011), that is, one's exercise identity, moderates affective and cognitive reactions to feedback on physical fitness.

1.1. Self-enhancement and self-consistency theories

Proponents of *self-enhancement theories* postulate that people strive for positive self-evaluations and undertake efforts to create a positive sense of self (e.g., Leary, 2007; Sedikides & Gregg, 2008). Thus, individuals are assumed to seek positive feedback to maintain or enhance a favorable view of themselves, even if this feedback is inconsistent with their self-view. This implies that people prefer to process positive, self-enhancing information, and reject feedback that threatens their positive self-image. Self-enhancement is achieved using a variety of information processing strategies discussed in sport and exercise psychology such as self-serving attributions (Mullen & Riordan, 1988), the strategic choice of social comparison targets (Van Yperen, 1992), and behavioral self-handicapping (Finez, Berjot, Rosnet, Cleveland, & Tice, 2012).

Proponents of *self-consistency theories* (the most prominent being self-verification theory) assume that people strive for information confirming their own firmly held self-views, even if this information is negative (Swann, 1983). According to these theories, people are motivated to maximize the extent to which their experiences confirm and reinforce their self-assessments. The reason people seek self-verification is that self-verifying evaluations make the world seem more coherent and predictable. Individuals use different strategies to self-verify (Swann & Buhrmester, 2012), namely biased information processing and constructing social environments that satisfy their needs.

Although self-enhancement and self-consistency theories differ in predicting the acceptance of enhancing (i.e., positive) and confirmative (i.e., consistent) feedback, a great deal of empirical evidence supports both theories, "with some studies favoring self-consistency theory and others favoring self-enhancement theory" (Swann, Griffin, Predmore, & Gaines, 1987, p. 882). One important variable that has been found to moderate whether self-relevant feedback is processed according to self-enhancement or to self-consistency principles concerns the *type of reaction*: Results of a review (Shrauger, 1975) and a meta-analysis (Kwang & Swann, 2010) indicate that affective responses (e.g., how happy someone is with feedback) are guided by self-enhancement motives (i.e., people affectively prefer positive feedback to consistent feedback), whereas cognitive responses (e.g., how accurate feedback is perceived) are in line with the predictions of self-consistency theories (i.e., people cognitively prefer consistent feedback to positive feedback). A theoretical reasoning for this result can be derived from dual-system theories according to which "the enhancement response is subject to an 'automatic process', and the consistency response is subject to a 'deliberative process'" (Burke & Stets, 2009, p. 167; see also; Swann, Hixon, Stein-Seroussi, & Gilbert, 1990).

1.2. The moderating role of identity

A second variable assumed to moderate whether self-enhancement or self-consistency principles guide the processing of self-relevant feedback is the *elaborateness of the self-aspect in question.* Highly elaborated self-aspects occupy a central position in the cognitive system (Markus & Wurf, 1987), are related to a number of other self-relevant cognitions (Petersen, Stahlberg, & Dauenheimer, 2000), and are represented clearly in an individual's self-concept. Therefore, highly elaborated self-aspects are quite resistant to change (Markus & Kunda, 1986). Constructs used to operationalize elaborateness of self-aspects include self-schemata (Markus, 1977), identities (Stryker & Burke, 2000), and self-certainty (Anseel & Lievens, 2006). In this study, the identity construct is used to facilitate comprehensibility. Two parallel literature address the moderating role of the elaborateness of self-aspects on information processing: identity theory and the integrative self-schema model.

Proponents of *identity theory* (Burke & Stets, 2009) assume that identities (i.e., highly elaborated self-aspects) provide a standard for behavior (identity control theory; Stryker & Burke, 2000) and individuals are motivated to verify their identities (e.g., feedback consistent with one's own self-assessment). Otherwise, the individual will feel negative affect in response to this nonverification. This negative affective reaction is then in turn thought to motivate the individual to reduce the mismatch and verify their identity (Burke, 2006; Stets & Burke, 2003). However, situations that are consistent with one's identity are assumed to evoke positive affect and increase self-efficacy with regard to performance (Stryker & Burke, 2000). Identity theory, therefore, assumes that for identities that occupy a central position in the self-representation, self-consistency principles guide information processing (i.e., consistent feedback is preferred to inconsistent feedback). Several studies provide evidence for these assumptions (e.g., Stets, 2005; Swann & Ely, 1984; Swann & Hill, 1982; Swann & Read, 1981). However, identity theory does not make predictions about what kind of information is preferred when a self-aspect is less elaborated.

Contrary to identity theory, the *integrative self-schema model* (Dauenheimer, Stahlberg, & Petersen, 1997, 1999; Petersen et al., 2000; Stahlberg, Petersen, & Dauenheimer, 1999) explicitly emphasizes the moderating role of identity regarding self-enhancement as opposed to self-consistency endeavors. Along the lines of identity theory, the authors assume that for self-aspects with which individuals identify strongly (called schematic self-aspects here), feedback consistent with one's own self-assessment can be integrated easily into the current cognitive representation, whereas inconsistent feedback is assumed to lead to cognitive inconsistencies (see also Festinger's, 1957, cognitive dissonance theory and Higgins', 1987, self-discrepancy theory). Therefore, individuals are expected to react in line with self-consistency theory with regard to self-aspects with which they identify strongly (i.e., they prefer consistent feedback to positive feedback). For example, individuals who identify strongly with being an exerciser have a clear image of themselves as an exerciser and are quite sure about their abilities in this domain. They might, therefore, question inconsistent feedback, such as getting overly positive feedback about their endurance abilities while knowing that endurance is not their forte. For self-aspects with which individuals identify less, integrating inconsistent but positive feedback into one's self-view is less problematic because these self-aspects have few connections to other cognitive representations. Therefore, individuals are expected to use the opportunity for self-enhancement (i.e., they prefer positive feedback to consistent feedback). The assumptions of the integrative self-schema model have been supported empirically by a series of studies of self-aspects such as spontaneity, considerateness, and masculinity (e.g., Dauenheimer, Stahlberg, & Petersen, 1999, 1997; Petersen et al., 2000; Stahlberg et al., 1999).

1.3. Previous studies in sport and exercise psychology

Exercise self-schema (Kendzierski, 1988) and exercise identity (Anderson & Cychosz, 1994) are theoretical constructs that can be used to operationalize the elaborateness of the self-as-exerciser (Mullen, 2011). While exercise self-schemata are cognitive generalizations about the self that are based on "an individual's experience associated with exercise, such as thoughts, feelings, and motor and autonomic responses to exercise" (Sabiston, Whitehead, & Eklund, 2012, p. 231), exercise identity refers to the "salience of an individual's identification with exercise as an integral part of the concept of self" (Anderson & Cychosz, 1994, p. 747). Berry, Strachan, and Verkooijen (2014) showed empirically that although the two constructs originate from different theoretical backgrounds, they are highly correlated. Also, in a meta-analysis and narrative review, Rhodes, Kaushal, and Quinlan (2016) concluded that exercise self-schema and exercise identity generally are commensurate constructs that can be used interchangeably to measure the extent to which individuals identify with being an exerciser. The main difference at an operational level is that use of the schema construct results in categorization of participants, whereas exercise identity scores can be used continuously.

Evidence for predictions made by *identity theory* in the context of exercise has been provided by Strachan and colleagues. They showed that individuals who identified strongly with being an exerciser displayed less positive affect and more negative affect when they perceived incongruence between their exercise identity meanings and situational meanings in hypothetical (Strachan & Brawley, 2008; Strachan, Flora, Brawley, & Spink, 2011) and prospective observational situations (Strachan, Brawley, Spink, & Jung, 2009; Strachan, Perras, Brawley, & Spink, 2016) than their counterparts with weaker exercise identities. In addition, they reported greater ability to self-regulate their exercise behavior (self-efficacy, intentions to exercise) when confronted with challenges to continue their identity-relevant behavior. Similar results were obtained when individuals who identified strongly with being an exerciser received identity-confirming or disconfirming feedback from others (Strachan, Stadig, Jung, & Semenchuk, 2018):

Participants who received identity-disconfirming feedback reported more negative and less positive affect and disagreed more with the feedback than participants who received consistent feedback.

We have tested the *predictions of the integrative self-schema model* in a previous online experiment (Ennigkeit & Hänsel, 2014) on which the present study builds. Participants ($N = 472$; 47.5% male) were between 17 and 71 years of age, and slightly more than half of them identified strongly with being an exerciser (exercise schematics, Kendzierski, 1988). They worked on an alleged newly developed test (questionnaire items and reaction tests) measuring various aspects of fitness and health. Afterwards they received randomized bogus feedback in six areas (e.g., physical fitness, sportiness, physical well-being) that either mirrored (consistent feedback) or deviated positively or negatively from their self-assessments. Affective and cognitive reactions were treated separately. The hypothesized moderating role of the self-as-exerciser on processing self-relevant feedback could not be found for either type of reaction: For both affective reaction and cognitive reaction, positive feedback was preferred to consistent feedback, suggesting a general dominance of the self-enhancement principle in the domain of sport and exercise. However, an unexpected interaction was found between exercise identity and reactions to consistent feedback and negative feedback for both types of reaction. This ordinal interaction indicates that the mean difference between reactions to consistent feedback and reactions to negative feedback was smaller for individuals who did not identify with being an exerciser, that is, the affective and cognitive preference for consistent feedback to negative feedback was more pronounced for individuals who identified strongly with being an exerciser.

1.4. The present study

The aim of the present study was to retest the central hypothesis that the strength of exercise identity moderates processing of self-relevant feedback on exercise. However, unlike in the aforementioned online experiment, we assessed elaborateness not in terms of exercise self-schema, but used the exercise identity construct instead because of its advantage of continuous measurement. Drawing on both the integrative self-schema model as well as identity theory, we hypothesized that exercise identity would moderate both affective reaction and cognitive reaction to self-relevant feedback on fitness. For *affective reaction* in particular, individuals with a weak exercise identity were expected to feel better after receiving positive feedback than after receiving consistent feedback. For individuals with a strong exercise identity, we predicted no difference in affective reaction between receiving positive feedback and receiving consistent feedback. The reason for this is that self-enhancement strivings (affective reaction) and self-consistency strivings (high level of elaborateness) co-occur and are assumed to eliminate each other. For *cognitive reaction*, individuals with a strong exercise identity were expected to favor consistent feedback over positive feedback. No difference in cognitive reaction was expected for individuals with a weak exercise identity due to the simultaneous impact of self-consistency strivings (cognitive reaction) and self-enhancement strivings (low level of elaborateness of the self-aspect in question).

2. Method

2.1. Overview

Unlike the previous experiment conducted online, the present study was conducted in a laboratory setting. The setting was expected to enhance both the personal meaning and the credibility of the feedback, as feedback was given by a human after (allegedly objective) physiological data was collected to assess physical fitness. The general idea behind the laboratory experiment was based on a method used in studies in which the integrative self-schema model (e.g., Petersen et al.,

2000) was tested: Using a cover story, we provided participants with bogus feedback generated from their self-assessments. We measured affective reactions and cognitive reactions to the feedback. Type of feedback (consistent with vs. deviating positively vs. deviating negatively from their self-assessed physical fitness) was chosen as the predictor for affective and cognitive reactions; exercise identity was chosen as a continuous moderator.

2.2. Participants

The convenience sample included $N = 215$ university students (64.2% male) between 18 and 30 years of age ($M_{age} = 23.82$ years, $SD = 2.32$). A priori power analyses using G*Power revealed that the predicted small to medium-sized moderation effects (increase in R^2, $f^2 = 0.05$) with $\alpha = 0.05$ and 80% power could be detected with this sample size. The expected effect size was based on results of previous investigations into the integrative self-schema model (e.g., Dauenheimer et al., 1999, 1997; Petersen et al., 2000; Stahlberg et al., 1999). As students of sport sciences and of kinesiology were excluded,[1] participants came from a variety of other degree programs, with most of them studying mechanical engineering (19.5%) or computer sciences (18.0%). The majority of the sample (83.3%) stated they exercised regularly, with fitness activities being the most frequently mentioned activities (55.6%), followed by team sports (17.4%). Participants received either 10 € or—in the case of psychology students—partial fulfillment of a research requirement in their introductory psychology class. To ensure a high quality of data, we excluded participants from the original sample ($N = 218$) who, during the debriefing process, suspected the underlying hypotheses of the study or expressed doubts about the credibility of the feedback. This applied to three participants only, indicating that the cover story was generally well accepted by the sample.

2.3. Procedure and instruments

The experiment involved the following steps: (1) presentation of cover story and obtainment of informed consent, (2) assessment of sociodemographic traits, (3) measurement of exercise identity, (4) self-assessment of physical fitness, (5) completion of the alleged fitness test ("FitnessIndex"), (6) presentation of bogus feedback generated from self-assessment (see step 4), (7) measurement of affective and cognitive reactions to the feedback and manipulation check, and (8) detailed debriefing. We conducted multiple pretests to examine the credibility of both the cover story and the generated bogus feedback as well as the comprehensibility of instructions and items. All participants were tested individually and instructed by the same (male) experimenter. The protocol was approved by the university's ethical commission and all participants provided written informed consent before data collection.

2.3.1. Cover story and sociodemographic traits

Participants expected to take part in a study in which evaluation was made of the subjective acceptance of a test measuring physical fitness without the need to exert themselves. The cover story was that this test, called "FitnessIndex", was developed by Polar (a company well-known for the production of heart rate monitors) in cooperation with sport and exercise scientists and that it had already been validated with objective data obtained in other fitness tests (to enhance the credibility). Participants were told that the test was used regularly in elite sports and in rehabilitation exercise classes and was now supposed

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[1] We excluded students of sport sciences and of kinesiology because we expected most of them to be familiar with Polar's OwnIndex function used in the manipulation of the fitness feedback (see "alleged fitness test"). This familiarity (and the possible knowledge of their true OwnIndex value) could have affected the credibility of the manipulated feedback. None of the participants in the study claimed to have had experience with Polar's OwnIndex function.

to be tested for use with other individuals, especially recreational exercisers and athletes. Afterwards, some basic sociodemographic data on the participants were collected.

2.3.2. Exercise identity

To assess exercise identity, we used a German translation (Ennigkeit & Hänsel, 2018) of the Exercise Identity Scale (EIS; Anderson & Cychosz, 1994). This nine-item scale is used to assess the extent to which participants identify with being an exerciser (e.g., "I consider myself an exerciser"). Items are rated on a seven-point Likert-type scale ranging from 1 = *strongly disagree* to 7 = *strongly agree*. Adequate reliability and validity of the EIS have been reported. The German translation showed a high level of internal consistency (Cronbach's α = 0.97) and temporal invariance over 14 days (Ennigkeit & Hänsel, 2018). In the present study, a Cronbach's α of 0.93 emerged. Several studies show strong associations between EIS scores and exercise behavior (e.g., Wilson & Muon, 2008) and social cognitive variables central to the regulation of exercise (e.g., exercise-related self-efficacy; Strachan et al., 2016), indicating construct validity of the instrument. The factorial structure of the EIS is subject to discussion, with some researchers arguing for a one-factor solution (e.g., Anderson & Cychosz, 1994; Reifsteck, Gill, & Labban, 2016) and others for a two-factor solution (e.g., Wilson & Muon, 2008). Results of an analysis of the German translation support the use of a total score (Ennigkeit & Hänsel, 2018); therefore, the mean of all nine items was used as a measure of exercise identity in the present study.

2.3.3. Self-assessment of physical fitness

On a slider scale ranging from *0%* on the left to *100%* on the right and increments of 10 labeled, participants completed the phrase "Compared to other people my sex and age, I am physically fitter than …"by indicating a value between 0 and 100%. An example was included to make sure participants understood the instruction ("A value of 30% means that you believe you are physically fitter than 30% of people in your comparison group. In other words: You believe that 70% of your comparison group are physically fitter than you.").

2.3.4. Alleged fitness test

After assessing their own physical fitness, participants were accompanied by the experimenter to another part of the room. For the alleged "FitnessIndex", we used the OwnIndex function implemented in some heart rate monitors produced by Polar. The OwnIndex test was developed to measure aerobic fitness (VO_2max) from heart rate and heart rate variability in a resting position and took approximately 5 min to complete. Whether the OwnIndex function delivers valid estimates of VO_2max is subject of debate (Esco, Snarr, & Williford, 2014; Jackson et al., 1990); however, the accuracy of the OwnIndex results was not of interest in the present study because bogus feedback was given instead.[2] After the participants put on the chest strap and sat on a massage table, their heart rate was measured and shown in real-time on a computer screen connected to the heart rate sensor using a self-written DasyLab program. This was done to ensure that the participants believed the (actually existing) connection between the chest strap and the computer which later provided the bogus feedback. During the alleged fitness test, the participants could not see their heart rate. The experimenter told the participants to relax in a lying position on the massage table until a sound signaled completion of the measurement, and then he left the participants alone.

2.3.5. Presentation of bogus feedback

After the OwnIndex measurement was completed, the experimenter

returned to the participant, and clicked on an "evaluate" button. The participants then were provided with bogus feedback in the form of an absolute value (*Your FitnessIndex is: X*) and, in a bigger font, a value in percent corresponding to the scale that was used for the self-assessment (*You are physically fitter than X% of your comparison group (people your sex and age)*). Contrary to what participants were told, the second part of the bogus feedback was based solely on their self-assessment. Participants were randomly assigned to one of three feedback conditions (*n* = 71 participants in both the negative and the consistent feedback conditions, *n* = 73 individuals in the positive feedback condition). In the consistent feedback condition, the result deviated only minimally from the participants' self-assessment (± 3%). In the positive feedback condition, a value of 23% was added, and in the negative feedback condition, a value of 23% was subtracted from the participants' self-assessments. The decision to make a 23-point difference was based on a pilot study by Stahlberg et al. (1999). As the scale could not go lower than 1% or higher than 99% (we judged values of 0 and 100 as not being credible), for some of the few participants who rated their fitness as being very poor or very good, the difference was lower than 23%. This applied to 10 participants; however, for only two of them the difference between their self-assessment and the bogus feedback was lower than 19%.[3]

2.3.6. Affective and cognitive reactions and manipulation check

Affective reaction to the feedback was assessed using a nine-item scale derived from Weiner's (1985) attributional theory of achievement attribution and emotion. The scale had been used in a number of other studies (e.g., Strachan & Brawley, 2008; Strachan et al., 2009) and consisted of positive and negative affective responses to achievement situations. Participants used a 10-point Likert-type scale (1 = *not at all* to 10 = *very much*) to indicate the extent to which they experienced positive and negative affect regarding the result of their fitness test (e.g., happy, proud, ashamed, disappointed). The negative affect items were reverse coded so that higher values indicated positive affect. To assess *cognitive reaction*, we used nine items adapted from Swann et al. (1987) and Woo and Mix (1997). The items were used to assess the perceived accuracy of the feedback (e.g., How accurate do you think this result was? How much could a stranger learn about you from seeing your test result?) and the perceived diagnosticity of the fitness test (e.g., How well do you think this test measures physical fitness?), and participants rated them on 10-point Likert-type scales labeled at the extremes. Higher values indicated a more positive cognitive reaction to the feedback. Means for the affective and cognitive scales were calculated. In the current sample, internal consistency was α = 0.92 for the affective subscale and α = 0.90 for the cognitive subscale. The correlation between affective reaction and cognitive reaction was *r* = 0.34, *p* < .001. In addition, to check whether the manipulation was successful, participants rated the extent to which their result on the fitness test met their expectations (1 = *worse than expected*, 10 = *better than expected*).

2.3.7. Debriefing

After completion of the experiment, participants were first invited to share any comments they had about the procedure. Afterwards, they were asked whether they thought the study had any purpose other than to assess subjective acceptance of the "FitnessIndex" in order to reveal any doubts they might have about the cover story. They then were fully debriefed about the purpose of the study, its expected findings, and the contrived nature of the feedback. The debriefing protocol was based on process debriefing (Ross, Lepper, & Hubbard, 1975), which involves providing participants with information on how the deceptive nature of

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[2] However, the real OwnIndex values of the participants were still recorded through the Polar heart rate monitor watch, which the participants did not see (they had the opportunity to see their real OwnIndex value during the debriefing process).

[3] We repeated hypotheses testing with these two individuals excluded (both were in the positive feedback condition). For affective reaction and cognitive reaction, the results remained qualitatively the same as those reported on in the results section.

Table 1
Moderated regression results for affective reaction.

	B [95% CI]	SE	β	t	p
Constant	7.56 [7.21, 7.90]	0.175		43.21	< .001
Exercise identity (centred)	0.46 [0.23, 0.70]	0.119	.38	3.90	< .001
Feedback[a]					
Negative	−1.39 [−1.88, −0.91]	0.247	−.35	−5.65	< .001
Positive	1.31 [0.82, 1.79]	0.245	.33	5.32	< .001
Interactions[a]					
Exercise identity x Negative feedback	−0.19 [−0.51, 0.13]	0.164	−.09	1.16	.248
Exercise identity x Positive feedback	−0.23 [−0.54, 0.09]	0.161	−.10	−1.39	.167

Note. $R^2 = .41$. R^2 increase due to interaction terms = 0.006, $p = .341$.
$F(5, 209) = 29.50$, $p < .001$.
[a] Consistent feedback was chosen as the reference category for dummy coding.

the feedback may have temporarily influenced their self-perceptions and the processes by which these effects occur. Finally, participants were offered the opportunity to see their true OwnIndex scores as measured by the Polar watch and the enclosed norm table; however, the experimenter informed participants about the heterogeneous results concerning the reliability and validity of this measure.

2.4. Data analysis

Findings of previous research suggest that affective and cognitive reactions can be considered as independent variables (e.g., Dauenheimer et al., 1999; Shrauger, 1975; Swann et al., 1987). Because of the special data patterns predicted for each dependent variable, we performed hypotheses testing separately for both types of reaction. Two moderated regression analyses with a multicategorical predictor were conducted using the PROCESS macro for SPSS (Hayes & Montoya, 2017). Feedback condition was dummy coded using consistent feedback as the reference category. Exercise identity and the two product terms were mean centred. Significant interaction effects were probed using the Johnson-Neyman technique for categorical independent variables implemented in the Omnibus Groups Regions of Significance SPSS macro (Hayes & Montoya, 2017), and pairwise comparisons were conducted in order to determine values of exercise identity that demarcate regions of significance for the difference coded by each dummy variable.

3. Results

3.1. Preliminary analyses

The EIS mean score for the whole sample was $M = 4.42$ ($SD = 1.54$, 95% CI [4.22, 4.63], Range: 1–7). Participants rated their physical fitness as being only slightly better than average ($M = 53.29\%$, $SD = 10.09$, 95% CI [50.74, 55.88], Range: 7–90), and mean self-assessments did not differ among the three feedback conditions, $F(1, 212) = 0.76$, $p = .469$, $\eta^2 = .007$. The correlation between exercise identity and self-assessment was $r = 0.60$, $p < .001$. No violations of multiple regression analyses' assumptions of normality, linearity, homoscedasticity, or independence were found, and no univariate or multivariate outliers were detected.

3.2. Manipulation check

An analysis of variance revealed that manipulation of the feedback was successful, $F(2, 212) = 152.85$, $p < .001$, $\eta^2 = .590$. Participants in the negative feedback condition perceived their test result to be worse than expected ($M = 3.75$, $SD = 1.76$, 95% CI [3.39, 4.12]) whereas participants in the consistent feedback condition felt their result met their expectations ($M = 5.76$, $SD = 1.41$, 95% CI [5.41, 6.13]) and participants in the positive feedback condition judged their result

as being better than expected ($M = 8.21$, $SD = 1.40$, 95% CI [7.86, 8.58]). Results of the Tukey's HSD post-hoc tests indicate that the three groups differed significantly (all $ps < .001$).[4] This result did not change when exercise identity was considered as a covariate, $F(2, 211) = 152.26$, $p < .001$, $\eta^2 = .591$.

3.3. Affective reaction

Results of the moderated regression analysis indicate that exercise identity did not moderate affective reaction to different types of feedback, with both interaction variables being nonsignificant (Table 1, see also Fig. 1) and the addition of the interaction terms not leading to a significant increase in explained variance, $\Delta R^2 = 0.006$, $p = .341$.[5] Type of feedback did predict affective reaction: Participants displayed less positive affect after being exposed to negative feedback than after being given consistent feedback, $\beta = -.35$, $t = -5.65$, $p < .001$, and more positive affect in response to positive feedback than to consistent feedback, $\beta = .33$, $t = 5.32$, $p < .001$.

3.4. Cognitive reaction

Exercise identity moderated cognitive reaction to the different types of feedback (Table 2, see also Fig. 2). Adding both interaction terms to the model significantly increased the amount of explained variance, $\Delta R^2 = 0.149$, $p < .001$, and both interaction terms were significant (exercise identity x negative feedback: $\Delta R^2 = 0.053$, $p < .001$; exercise identity x positive feedback: $\Delta R^2 = 0.019$, $p = .018$), indicating that exercise identity moderated the comparison of consistent feedback and negative feedback as well as the comparison of consistent feedback and positive feedback. Application of the Johnson-Neyman technique for independent categorical variables revealed significant interaction effects in most of the range of exercise identity scores, with the exception of exercise identity mean scores between approximately 2.50 and 3.10.

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[4] When using a 10-point scale, the manipulation check item did not allow for a neutral midpoint (i.e., complete consistency); therefore, we examined whether participants' ratings differed significantly from the midpoint of the scale (= 5.5) in the three conditions. This was the case for the negative feedback condition, $t(70) = -8.38$, $p < .001$, $d = -1.00$, and the positive feedback condition, $t(72) = 16.47$, $p < .001$, $d = 1.93$, but not for the consistent feedback condition, $t(70) = 1.56$, $p = .124$, $d = 0.19$, which further strengthened our belief that the manipulated feedback was perceived as intended.

[5] As it can be argued that reverse coding the negative affect items and creating an overall affect scale does not capture the nature of affective reaction adequately, we performed the analysis again separately for positive affect and negative affect. Doing so did not change the main result that exercise identity did not moderate affective reaction to different types of feedback: For *negative affect*, adding both interaction terms to the model did not significantly increase the amount of explained variance, $\Delta R^2 = 0.007$, $p = .365$. For *positive affect*, although the addition of both interaction terms just reached statistical significance, $\Delta R^2 = 0.017$, $p = .040$, this was due to the comparison of consistent feedback and negative feedback only, $p = .012$. Further probing of this interaction using the Johnson-Neyman technique yielded no significant bounds, casting doubt about the trustworthiness of this interaction effect. For the hypothesized interaction between consistent and positive feedback, no significant moderation effect was found, $p = .262$.
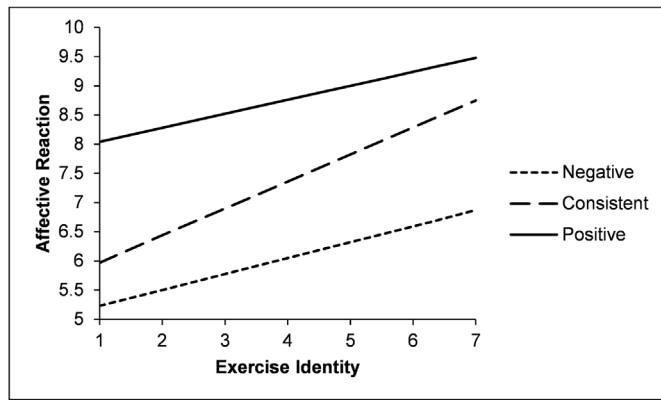
Fig. 1. Affective reaction to different types of feedback at different levels of exercise identity.
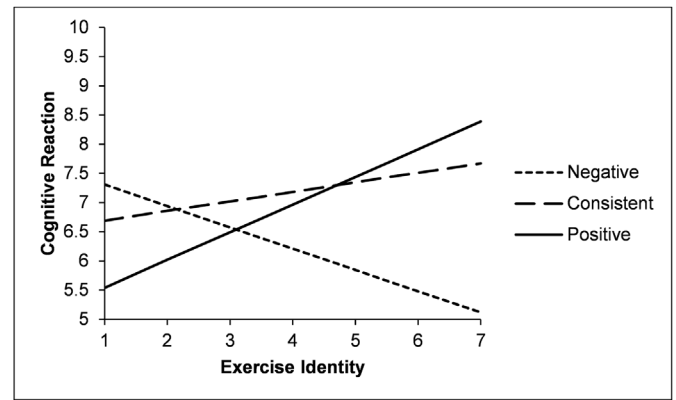

Fig. 2. Cognitive reaction to different types of feedback at different levels of exercise identity.

Further examination of the interaction between the *consistent feedback and the positive feedback* conditions revealed a significantly more positive cognitive reaction to consistent feedback for individuals with a weak exercise identity (*M* approximately < 2.90), which is contrary to the hypothesized effect. For all other exercise identity scores, no differences were found in cognitive reaction between the consistent feedback and the positive feedback conditions.

Further probing of the interaction between *consistent feedback and negative feedback* showed that for individuals with a stronger exercise identity (*M* approximately > 3.20), the cognitive reaction to negative feedback was significantly more negative than the reaction to consistent feedback, whereas for individuals with weak exercise identity mean scores, no difference was found between the reaction to consistent feedback and the reaction to negative feedback.

4. Discussion

The aim of the present study was to examine the moderating role of exercise identity in the processing of feedback on physical fitness. Based on the assumption that a stronger exercise identity equals a highly elaborated cognitive representation of the self-as-exerciser, we hypothesized that the strength of exercise identity would moderate affective and cognitive reactions to consistent feedback vs. positive feedback. Concerning affective reaction, individuals with a weak exercise identity were expected to feel better after receiving positive feedback than after receiving consistent feedback, whereas no difference in affective reaction was predicted for individuals with a strong exercise identity.

Contrary to expectations, *affective reaction* was not moderated by the strength of exercise identity. Regardless of how much participants identified with being an exerciser, they reported more positive affect in response to positive feedback than to consistent feedback. Further, affective reaction was more positive for consistent feedback than for negative feedback. Thereby, this result supports the predictions of self-enhancement theories. It also confirms the results of the previous online study (Ennigkeit & Hänsel, 2014). To conclude, results of both studies suggest that in the domain of exercise how strongly one identifies with being an exerciser does not seem to moderate information processing, and that self-enhancement strivings related to the affective nature of the reaction (Kwang & Swann, 2010; Shrauger, 1975) override any effects pertinent to exercise identity. Similar results have been found in an identity theory framework. In a series of studies, Stets (e.g., 2005; Stets & Asencio, 2008; Stets & Osborn, 2008) obtained results similar to ours for worker identity. Taken together, it seems that individuals affectively welcome positive feedback over consistent feedback quite consistently regardless of how strongly they identify with the self-aspect in question.

In terms of *cognitive reaction*, we assumed that individuals would react more positively to consistent feedback than to positive feedback when exercise identity was strong, whereas for individuals with a weak exercise identity, we expected no difference between the reaction to positive feedback and the reaction to consistent feedback. In fact, exercise identity strength did moderate cognitive reaction to different types of feedback. This was true for the hypothesized comparison of consistent feedback and positive feedback as well as for the comparison of consistent feedback and negative feedback.

Table 2
Moderated regression results for cognitive reaction.

	B [95% CI]	SE	β	t	p
Constant	7.25 [6.97, 7.52]	0.141		51.30	< .001
Exercise identity (centred)	0.16 [−0.25, 0.35]	0.096	.18	1.71	.089
Feedback[a]					
Negative feedback	−1.19 [−1.59, −0.80]	0.199	−.40	−5.99	< .001
Positive feedback	−0.08 [−0.48, 0.31]	0.198	−.03	−0.43	.671
Interactions[a]					
Exercise identity x Negative feedback	−0.53 [−0.79, −0.27]	0.133	−.34	−4.00	< .001
Exercise identity x Positive feedback	0.31 [0.05, 0.57]	0.130	.20	2.38	.018

Note. $R^2 = 0.30$. R^2 increase due to interaction terms = 0.149, $p < .001$.
$F(5, 209) = 18.25$, $p < .001$.
[a] Consistent feedback was chosen as the reference category for dummy coding.

However, regarding the hypothesized interaction between *consistent feedback and positive feedback*, we found a pattern contrary to the one we expected: Individuals with a very weak exercise identity cognitively rated consistent feedback as more welcomed than positive feedback, whereas for all other participants, including those with a strong exercise identity, cognitive reaction to consistent feedback and positive feedback did not differ significantly. It is noteworthy, however, that any point of transition identified by the Johnson-Neyman method used in this article is merely a point estimate subject to sampling variance (Hayes & Montoya, 2017). Still, it is surprising that individuals with a weak exercise identity cognitively reacted more positively to consistent feedback than to positive feedback. Quite likely, individuals with a very weak exercise identity are those who have no relationship to exercise whatsoever and probably assessed their physical fitness as being rather low. It is possible that these people actually identify strongly with *not* being an exerciser (similar to what Kendzierski, 1988, called non-exerciser schematics, see also the sedentary identity concept; Rhodes et al., 2016), meaning their belief about themselves as being non-exercisers also is quite resistant to change. Therefore, they would not find feedback credible if it deviated positively from their own self-assessment because they are quite certain about their identity as a non-exerciser. It also is possible they strive less for positive feedback because this is not part of their ideal self. If this is true, exercise identity would actually moderate the processing of exercise-related feedback, and this would apply for individuals who see "nonexercise" as self-descriptive and an important part of their self-image. Furthermore, unexpected information generally is perceived as less trustworthy and less diagnostically accurate than information that is consistent with pre-existing expectancies (e.g., Edwards & Smith, 1996; Swann et al., 1987).

For the interaction between *consistent feedback and negative feedback* no specific hypothesis was formulated. We found that the stronger the exercise identity, the larger the "gap" between the reaction to these two types of feedback: Cognitive reaction to negative feedback became more negative with stronger exercise identity, whereas consistent feedback was received more positively as exercise identity became stronger. This result supports the result of the previous online study (Ennigkeit & Hänsel, 2014). Even though the original hypothesis concerning the reaction to consistent feedback compared to the reaction to positive feedback was not supported, the interaction between the reaction to consistent feedback and the reaction to negative feedback could be integrated into the hypothesized moderating role of exercise identity: Results of the online study and the laboratory study both indicate that individuals who strongly identified with being an exerciser valued consistent feedback over negative feedback more than individuals who did not consider exercise to be a central part of their self. However, this rejection of negative feedback does not clearly support the presuppositions of self-enhancement or self-consistency theories because it could serve either purpose. In fact, Sedikides (2012) argues that protecting the self from negative (self-threatening) feedback might be a distinct motive which he terms the self-protection motive. In any case, the results of both studies indicate that the strength of exercise identity does indeed moderate cognitive processing of self-relevant information. However, this seems to affect mostly reactions to negative feedback (in relation to consistent feedback). Thus, it could be worthwhile to focus on coping with failure at a behavioral level, which could have practical consequences for coaches and instructors of sport and exercise. For example, Renner (2004) showed that although participants receiving information about elevated cholesterol levels (which equals negative feedback) reacted cognitively more negatively to the test result, they also were more inclined to change their behavior than individuals receiving positive feedback.

It also should be noted that when studying cognitive reactions to non-verifying feedback, identity theory typically has focused on constructs such as self-efficacy rather than accuracy or credibility of feedback (e.g., Burke & Stets, 2009). Identity-verifying information is

thought to lead to a heightened sense of self-efficacy which in turn affects future behavior. It is possible that assessing individuals' perceived competence, intentions to exercise, or exercise self-efficacy after providing consistent or inconsistent feedback on physical fitness (e.g., Strachan & Brawley, 2008) would lead to different results than the ones we observed in the present study (accuracy of the result and diagnosticity of the fitness test).

The pattern of results observed both in the previous online study (Ennigkeit & Hänsel, 2014) and in the present study seems to occur independently from operationalization of the elaborateness of the exercise-related self-aspect as self-schema or identity. As outlined in the introduction, there is substantial conceptual overlap between self-schema and identity. The results found in this study therefore confirm the results of other studies, showing that operationalization of the construct as an identity or as a schema is relatively negligible (Rhodes et al., 2016, p. 218).

Our results contradict those of studies of the integrative self-schema model (e.g., Dauenheimer et al., 1999; Petersen et al., 2000; Stahlberg et al., 1999). One possible reason is that the self-enhancement principle might generally be more pronounced in settings related to performance or with self-aspects in which maximum value seems more desirable than optimum value (Dauenheimer et al., 1997). In contrast to personality traits investigated in most studies to test the integrative self-schema model (such as spontaneity), exercise usually is perceived as a domain in which maximum values are desirable. Further, unlike personality traits, fitness might be perceived as being more dependent on one's own efforts. Moreover, it is possible that consistent feedback is perceived as positive, especially when exercise identity is strong and the level of corresponding self-assessments is high.

It should be pointed out that the processing of self-relevant information is affected by a number of other variables, especially those concerning motivational factors. For example, Anseel, Van Yperen, Janssen, and Duyck (2011) showed that achievement motivation moderates feedback reaction: Individuals pursuing performance-approach goals reacted more negatively to comparative feedback relative to individuals pursuing mastery-approach goals. In our study, feedback was given in a social comparative form, but we did not assess participants' achievement orientation.

A few limitations of this study must be acknowledged. First, the sample was comprised of university students aged 18 to 30. Whether our results can be generalized to children and adolescents, older adults or individuals with a different educational background is unknown. Second, the feedback provided to participants was based on an alleged "real-world" test involving objective, physiological data (heart rate variability). Although this can be seen as an improvement over the previous online study (Ennigkeit & Hänsel, 2014) in terms of the personal meaning of the feedback to the individuals, it is possible that receiving feedback after completing a fitness test that involved physical exertion would be perceived as being even more relevant for the self. Third, it is possible that information on physical fitness derived from heart rate readings may not constitute important pieces of identity-relevant feedback for some exercisers (e.g., someone who does not engage in aerobic exercise; Strachan, Perras, Forneris, & Stadig, 2015). However, physical fitness consistently is linked to how the self-as-exerciser is perceived, and exercise identity shows the closest association with more vigorous forms of physical activity (e.g., Dunton, Schneider, Graham, & Cooper, 2006; Raudsepp, Liblik, & Hannus, 2002). Therefore, feedback on physical fitness through heart rate readings was expected to provide most of the participants of the present study with identity-relevant information especially because individuals engaging in fitness activities and team sports constituted the majority of our sample. Finally, while affective and cognitive reactions were each assessed with only two items in the previous online study, we increased the reliability of these measures by using multiple item rating scales. However, it is possible that further differentiation (e.g., treating positive and negative affective reactions separately; Ilies, De Pater, & Judge,

2007) and inclusion of other types of reactions (e.g., behavioral reactions such as interpersonal behavior, feedback seeking and subsequent exercise behavior) could be beneficial.

In terms of practical implications, our results seem to indicate that positive feedback (i.e., feedback deviating positively from one's self-assessment) leads to more positive emotions and is perceived as being more accurate than feedback consistent with one's self-assessment. Research has shown that positive feedback on exercise enhances intrinsic motivation, perceived competence and performance (e.g., Mouratidis et al., 2008; Whitehead & Corbin, 1991; Ávila et al., 2012). Taken together, these results suggest that coaches or instructors should provide exercisers with positive feedback—even if it is false—which cannot be justified from an ethical point of view. However, providing feedback that emphasizes success, that is, good attempts or good effort, seems to have similar effects (Badami, VaezMousavi, Wulf, & Namazizadeh, 2011). Most of the studies of effects of feedback on intrinsic motivation and motor performance have involved a positive and a negative condition only and have not involved a "neutral" feedback condition. Further, the effect of participants' self-assessments and how strongly they identified with being an exerciser were not investigated. Therefore, in future studies comparison could be made of a neutral feedback (equaling the individual's self-assessment) condition and a positive feedback condition, and measures used in this study (exercise identity, affective reaction, perceived accuracy of the feedback) could be combined with measures used in studies of the effects of feedback on motivation and motor performance.

To conclude, results of our study suggest that affective reaction to feedback on physical fitness is driven by self-enhancement strivings, regardless of the strength of one's exercise identity. For cognitive reaction, strength of exercise identity seems to play a moderating role but not necessarily in the expected direction. Instead, individuals with a strong exercise identity disregarded negative feedback more than consistent feedback. Further studies are needed in which investigation is made into more relevant moderating variables in order to examine the interplay between the processing of exercise-related feedback and structural characteristics of the self.

Conflicts of interest

None.

Acknowledgments

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.psychsport.2018.03.008.

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Anhang D: Erklärungen und Stellungnahmen

Eidesstattliche Erklärung

Ich erkläre hiermit, dass die vorliegende Dissertation selbstständig verfasst wurde und keine anderen als die angegebenen Hilfsmittel verwendet wurden.

Ich erkläre hiermit gleichermaßen, dass die Stellen der Dissertation, die anderen Werken dem Wortlaut oder dem Sinn nach entnommen sind, durch Angabe der Quellen kenntlich gemacht wurden.

Weiterhin erkläre ich, dass ich zuvor keine Promotionsverfahren beantragt habe und dass mir die Promotionsordnung bekannt ist.

_____   _____

Ort, Datum   (Fabienne Ennigkeit)

Stellungnahme zu den Kriterien (1) bis (7) für kumulative Dissertationen im Fachbereich Psychologie und Sportwissenschaften, Goethe-Universität Frankfurt in der Fassung vom 11.06.2015

(1) Die kumulative Dissertation soll in der Regel 3 Schriften umfassen, die aus den letzten 5 Jahren stammen sollen.

Die vorgelegte Dissertation umfasst drei Schriften, die aus den Jahren 2014 bis 2018 stammen:

- Schrift 1: Ennigkeit, F. & Hänsel, F. (2018). Factorial and convergent validity of the Exercise Identity Scale in a German adult sample. *Measurement in Physical Education and Exercise Science*. Advance online publication. doi:10.1080/1091367X.2018.1474113.
- Schrift 2: Ennigkeit, F. & Hänsel, F. (2014). Effects of exercise self-schema on reactions to self-relevant feedback. *Psychology of Sport and Exercise, 15*, 108–115. doi:10.1016/j.psychsport.2013.10.008
- Schrift 3: Ennigkeit, F., Hänsel, F. & Heim, C. (2018). Does exercise identity moderate affective and cognitive reactions to feedback on physical fitness? *Psychology of Sport and Exercise, 37*, 10–18. doi:10.1016/j.psychsport.2018.03.008

(2) Die Schriften sollen im Wesentlichen einem zusammenhängenden Forschungsprogramm entstammen. Die jeweils verfolgten Forschungsfragen sollen sich sinnvoll zueinander in Beziehung setzen lassen.

Die drei Schriften entstammen im Wesentlichen einem zusammenhängenden Forschungsprogramm. Ziel dieses Forschungsprogrammes ist die Untersuchung der moderierenden Wirkung der Elaboriertheit des sportbezogenen Selbstaspekts bei der Verarbeitung selbstbezogener Informationen. Für die Operationalisierung der Elaboriertheit des sportbezogenen Selbstaspekts wird dabei einerseits das Exercise Self-Schema (Studie 2) und andererseits die Exercise Identity (Studie 3) herangezogen. Da für die Erfassung der Exercise Identity bisher nur ein englischsprachiges Instrument vorlag, wurde dieses zunächst ins Deutsche übersetzt und validiert (Studie 1).

(3) Der Kandidat oder die Kandidatin soll bei 2 Publikationen Erstautor/Erstautorin sein, bei einer weiteren Publikation kann er/sie Koautor/Koautorin sein. Eine geteilte Erstautorenschaft wird für jeden der Erstautoren anteilig gewichtet (bei 2 Erstautoren eine 1/2 Erstautorenschaft, bei 3 eine 1/3 Erstautorenschaft usw.).

Die Kandidatin ist bei allen drei Schriften Erstautorin.

(4) Die drei Schriften sollen zur Veröffentlichung zumindest eingereicht sein. Der aktuelle Status ist detailliert darzulegen (Publikationsorgan und Status wie eingereicht, in revision, conditional accept usw.).

- Schrift 1 wurde bei der Zeitschrift *Measurement in Physical Education and Exercise Science* zur Veröffentlichung angenommen und ist online bereits erschienen.
- Schrift 2 wurde 2014 in der Zeitschrift *Psychology of Sport and Exercise* veröffentlicht.
- Schrift 3 ist zur Veröffentlichung bei der Zeitschrift *Psychology of Sport and Exercise* angenommen und wird in Band 37 (2018) erscheinen.

(5) Mindestens 2 der 3 Schriften müssen in guten oder sehr guten, in der Regel englischsprachigen, Zeitschriften mit Peer-Review eingereicht sein.

- Schrift 2 ist in der Zeitschrift *Psychology of Sport and Exercise* erschienen. Diese Zeitschrift gehört mit einem Impact Factor von 2.8 (5-Year Impact Factor: 3.1, H-Index: 61) zu den internationalen Top-Zeitschriften mit Peer-Review-Verfahren im Bereich der Sportpsychologie. Schrift 3 wurde bei derselben Zeitschrift zur Veröffentlichung angenommen und ist online bereits erschienen.
- Schrift 1 wurde bei der Zeitschrift *Measurement in Physical Education and Exercise Science* zur Veröffentlichung angenommen (H-Index: 31). Es handelt sich um die einzige internationale Peer-Review-Zeitschrift mit methodischer Ausrichtung im Bereich der Sportwissenschaften.

(6) Eine der 3 Schriften kann als Publikation in einem einschlägigen Lehrbuch, Enzyklopädieband oder einem anderen für das jeweilige Fach bedeutsamen Publikationsorgan, jeweils mit Peer-Review, eingereicht oder veröffentlicht sein.
entfällt

(7) Die als Dissertation vorgelegte Abhandlung soll über die zusammengestellten Publikationen hinaus einen zusätzlichen Text enthalten, in welchem eine kritische Einordnung der eigenen Publikationen aus einer übergeordneten Perspektive heraus vorgenommen wird. Dieser Text sollte einen Umfang von ca. 30 Seiten haben. Es sollen die Fragestellungen theoretisch entwickelt werden, die empirischen Arbeiten und ihre Ergebnisse so dargestellt werden, dass sie auch ohne Lesen der Einzelarbeiten nachvollziehbar sind und es soll eine Gesamtdiskussion enthalten, die die Fragestellungen beantwortet und den Erkenntnisgewinn der Arbeit herausstellt.
Die vorgelegte Dissertation umfasst einen zusätzlichen Text, der den geforderten Kriterien entspricht.

_____   _____
Ort, Datum   (Fabienne Ennigkeit)

Gesonderte Erklärung zu Punkt (8) der Kriterien für kumulative Dissertationen im Fachbereich Psychologie und Sportwissenschaften, Goethe-Universität Frankfurt in der Fassung vom 11.06.2015

(8) Die Dissertation muss eine Erklärung enthalten, in der die Eigenleistung des Kandidaten/der Kandidatin dargestellt wird. Insbesondere bei Schriften mit Koautoren, aber auch bei in Einzelautorenschaft entstandenen Schriften, die oft auch im Rahmen von Abteilungsprojekten, Drittmittelprojekten, Projektverbünden usw. entstanden sind, soll dargelegt werden, welchen Anteil die Kandidaten an Entwicklung der Fragestellung, Design, Durchführung, Auswertung der empirischen Studie(n) und an dem Abfassen der einzelnen Beiträge hatten. Diese Erklärung ist von Betreuer und/oder Koautoren zu bestätigen.

Schrift 1

Die Verfasserin der vorliegenden Dissertation ist Erstautorin (Zweitautor: Prof. Dr. Frank Hänsel, Technische Universität Darmstadt). Die Fragestellung wurde von Frank Hänsel und der Verfasserin der vorliegenden Dissertation, Fabienne Ennigkeit, gemeinsam entwickelt. Das Untersuchungsdesign wurde von beiden Autoren unter Mitwirkung von Johanna Kunkel (zu diesem Zeitpunkt studentische Hilfskraft am Arbeitsbereich Sportpsychologie des Instituts für Sportwissenschaft der Technischen Universität Darmstadt) geplant. Die Rekrutierung der Versuchspersonen und die Datenerhebung erfolgten durch Fabienne Ennigkeit und Johanna Kunkel. Die Datenauswertung wurde im Wesentlichen von Fabienne Ennigkeit durchgeführt. Fabienne Ennigkeit verfasste den ersten Entwurf des Manuskripts, Frank Hänsel nahm eine kritische Durchsicht vor und lieferte Überarbeitungshinweise.

Schrift 2

Die Verfasserin der vorliegenden Dissertation ist Erstautorin (Zweitautor: Prof. Dr. Frank Hänsel, Technische Universität Darmstadt). Die Fragestellung sowie das Untersuchungsdesign wurden von Frank Hänsel und der Verfasserin der vorliegenden Dissertation, Fabienne Ennigkeit, gemeinsam entwickelt. Die Datenerhebung und Datenauswertung erfolgten im Wesentlichen durch Fabienne Ennigkeit, mit Unterstützung durch Frank Hänsel. Der erste Entwurf des Manuskripts wurde von Fabienne Ennigkeit verfasst, Frank Hänsel nahm eine kritische Durchsicht vor und lieferte Überarbeitungshinweise.

Schrift 3

Die Verfasserin der vorliegenden Dissertation ist Erstautorin (Zweitautor: Prof. Dr. Frank Hänsel, Drittautor: Prof. Dr. Christopher Heim). Die Fragestellung sowie das Untersuchungsdesign wurden von Frank Hänsel und der Verfasserin der vorliegenden Dissertation, Fabienne Ennigkeit, unter Mitwirkung von Christopher Heim und Wanja von der Felsen (zu diesem Zeitpunkt Kandidat für die Erstellung seiner Abschlussarbeit am

Arbeitsbereich Sportpsychologie des Instituts für Sportwissenschaft der Technische Universität Darmstadt) gemeinsam entwickelt. Die Programmierung des fingierten Feedbacks auf der Basis der Herzfrequenz mithilfe von Soscisurvey sowie Dasylab erfolgte durch Tobias Kaminsky (zu diesem Zeitpunkt studentische Hilfskraft am Institut für Sportwissenschaft der Technische Universität Darmstadt) sowie Reinhardt Fichte (zu diesem Zeitpunkt Mitarbeiter am Institut für Sportwissenschaften der Goethe-Universität Frankfurt). Die Daten wurden im Wesentlichen durch Wanja von der Felsen erhoben, mit Unterstützung von Fabienne Ennigkeit und Christopher Heim. Die Datenauswertung wurde durch Fabienne Ennigkeit vorgenommen. Fabienne Ennigkeit verfasste den ersten Entwurf des Manuskripts, Frank Hänsel nahm eine kritische Durchsicht vor und lieferte Überarbeitungshinweise.

_____   _____

Ort, Datum   (Fabienne Ennigkeit)

Hiermit bestätige ich die Gültigkeit der Erklärung von Frau Fabienne Ennigkeit.

_____   _____

Ort, Datum   (Frank Hänsel)

Hiermit bestätige ich die Gültigkeit der Erklärung von Frau Fabienne Ennigkeit.

_____   _____

Ort, Datum   (Christopher Heim)