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The experience of gratification and compensation in addictive behaviors: How can these experiences be measured systematically within and across disorders due to addictive behaviors?

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ABSTRACT

Background: Beyond gaming disorder and gambling disorder, pornography-use disorder, buying-shopping disorder, and social-networksuse disorders are discussed as further disorders due to addictive behaviors. For addictive behaviors, it is assumed that the experience of gratification and the experience of compensation due to the specific behavior represent reinforcing processes involved in the development and maintenance of the problematic behaviors. We aimed to develop two questionnaires that capture the experienced gratification and experienced compensation while using online activities. We additionally assume significant relationships with further addiction-related constructs such as symptom severity, use expectancies, and craving experiences.
Methods: We conducted three studies for the development of the "Experience of Gratification Scale" (EGS) and the "Experience of Compensation Scale" (ECS). In each study, participants answered the questionnaires modified for their preferred online activity (gaming, gambling, buying-shopping, social-networks use, pornography use). Additional questionnaires were used, assessing further addiction-related constructs.
Results: The results of the gradual approach by using exploratory and confirmatory factor analyses indicated for both scales a two-factor solution resulting in "gratification of needs" and "experience of pleasure" for the EGS, and "compensation of needs" and "experience of relief from negative feelings" for the ECS. The factors were significantly correlated with each other as well as with craving experiences, use expectancies, and symptom severity. Moreover, we found significant differences in the experienced gratification and experienced compensation for specific online behaviors.
Conclusion: The theoretically plausible specific factors for experienced gratification and experienced compensation could be identified and were related to constructs considered important in addictive online behaviors. Further studies should investigate the relevance of these constructs for different types of addictive behaviors, but also within the addiction process addressing specific needs and motives as well as further positive and negative reinforcement mechanisms.

1. Introduction

With the inclusion of gaming disorder and gambling disorder in the ICD-11, addictive online behaviors are becoming a focus in public discussions and addiction research as one specific type of maladaptive online behaviors. In the ICD-11, gaming disorder and gambling disorder are classified as "disorders due to addictive behaviors", and gaming disorder is defined as a "pattern of persistent or recurrent gaming behavior" which can occur predominantly occur online or offline. The three ICD-11 core criteria are 1) impaired control over gaming, 2) increasing priority given to gaming, and 3) continuation or escalation of the behavior despite the experience of negative consequences in different areas of functioning, which overall lead to marked distress or significant functional impairments [1].

Besides the ICD-11 categories 6C50 for gambling disorder and 6C51 for gaming disorder, the designation "other specified disorders due to addictive behaviors" (6C5Y) has been included, but without further definition, yet. Many researchers and clinicians have emphasized that in

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addition to gaming disorder and gambling disorder, other (online) behaviors may also be considered as possible disorders due to addictive behaviors, such as: problematic use of pornography [2], pathological online buying or buying-shopping disorder [3], and problematic use of social networks or social-networks-use disorder [4,5]. Brand, Rumpf [6] discussed these candidates as potential other specified disorders due to addictive behaviors by using three meta-criteria, which must be fulfilled: 1) clinical relevance, 2) theoretical embedding, and 3) empirical evidence of underlying mechanisms. However, there is a close link between theoretical embedding and the definition of underlying mechanisms, since theoretical models should define processes and factors, which must then be investigated empirically.

One of the current models of addictive behaviors is the I-PACE model by Brand and colleagues [Interaction of Person Affect Cognition Execution model; 7], and its updated version [8], which addresses the interactions of predisposing variables, affective and cognitive responses to internal and external triggers, as well as executive functions and (specific) inhibitory control leading to the engagement in the behavior and the experience of gratification and compensation. The repeated running through this enhancing process may result in diminished control, and later in an addictive behavior. Experiences of gratification and experiences of compensation while using the applications are considered important features of the positive and negative reinforcement mechanisms involved in the addiction process. Both constructs of experienced gratification and experienced compensation could be integrated in the theoretical assumptions of addiction research, however, this is not exclusive since it could, in principle, also represent parts of a functionally integrated behavior in everyday life, which is emphasized by further theoretical considerations apart from the addiction framework.

Experience of gratification may be considered the result of satisfying basic psychological needs such as competence, autonomy, and social belonging as well as hedonistic aspects as defined in the Self-Determination Theory [9–11]. The Uses and Gratification Approach [12,13] in media psychology outlines that users select those online activities that are linked to experiences of gratification. Here, central features are entertainment, finding information, and social interaction, resulting in a repeated use. For experiencing compensation, the Uses and Gratification Approach argues that specific needs are not satisfied in general but can be fulfilled by the specific media usage. Consistent with this, Müller and Wölfling [14] highlight that subjective stress and dysfunctional coping combined with specific motivational factors could result in a problematic use of online applications, based on positive and negative reinforcement mechanisms. These illustrate that in the course of the development of problematic, addiction-like use, it may be learned over time that the use of specific applications may reduce negative emotions, e.g., in the case of unsatisfied needs or experienced stress. The usage behavior may then manifest itself over the course of the addiction process, the users may experience negative consequences from the usage. The transactional model of stress and coping [15,16] suggests that individuals evaluate the relevance of an experienced situation (primary appraisal) according to whether it is irrelevant, positive, or stressful. In the second appraisal, a devaluation takes place based on various factors such as situational demands (challenge of the situation, possible threat, possible harm, or loss) and the individual resources and strategies to cope with it. Therefore, a balance between those demands and the evaluation as well as the usage of the coping strategy and possible consequences is needed [16]. If the approaches are combined, it can be assumed that subjectively perceived deficits but also stressful situations can lead individuals to try to deal with these situations as well as with negative emotions and subjectively unsatisfied needs by using (dysfunctional) coping strategies or by compensating them with a certain behavior such as online shopping, gaming, or pornography use. Based on positive and negative reinforcement learning, addictive behaviors may develop [for a more comprehensive perspective regarding the development and maintenance of addictive online behavior see 17].

In the I-PACE model, it is also argued that the use of the first-choice application, for example social networks, leads to the experience of gratification and therefore initiates positive reinforcement mechanisms, which make it an extremely attractive behavior for at least a short period of time [see also 18,19]. Moreover, experienced gratification is an important process, for example for satisfying desires and craving, but also for the stabilization of the behavior based on conditioning [20–23]. The usage of the applications and the experience of gratification may then change specific use expectancies contributing to diminished control. The assumed learning processes affect the gratification experience in this "vicious circle", which may shift from gratification to compensation during the addiction process. The compensation of subjective deficits is the first experience of negative consequences such as social isolation or loneliness whereas the behavior or the choice for a specific application is an approach to cope with or to try reducing such feelings [24,25]. Brand, Wegmann [8] highlight the shift from gratification to compensation as part of the shift from early to later stages of the addiction process. This shift could be compared with the shift between "liking" and "wanting" [21,26]. Since liking might represent a more hedonic, positive annotated character of the addiction process, wanting is characterized as incentive motivation, which becomes more dominant resulting in the avoidance of withdrawal symptoms, escapism, and reduction of negative emotions [27,28]. Although, the shift from liking to wanting cannot be equated with the experience of gratification to compensation, it could be assumed that in the development and maintenance of a problematic, addictive online behavior, theoretical considerations outline that there may be a shift from positive experiences and positive reinforcement mechanisms to (additionally) rather negative reinforcement. It can thus be assumed that experienced gratification plays a stronger role, especially at the beginning, while the experience of compensation and negative reinforcement becomes more dominant in the course of the process. Thereby, especially based on negative reinforcement, compulsive behaviors may develop later in the addiction processes, even if the involvement of reinforcement mechanisms and compulsivity could be assumed to be individually different [17].

From an empirical perspective, there are only few studies which directly address the relevance of experienced gratification and experienced compensation in different addictive behaviors. For the experience of gratification, mainly a motivational psychological perspective was used in previous studies. However, using motives may be understood most appropriately as a variable based on the expected outcome of the behavior that drives individuals to use an application. This does not necessarily involve the actual experience of gratification while using an application. Previous studies were mainly based on the Uses and Gratification Approach to illustrate various motives, which should be fulfilled using social networks [e.g., 29,30] or the Internet in general [31]. Bae [32] showed that discrepancies between obtained and sought gratification results in more intensive social-networks use. Huang, Hsieh [33] and Du, Kerkhof [34] specify the relevance of experiencing social gratification by using social networks. Moreover, in line with previous theoretical considerations, the expectancies to receive social gratification is related to the preference of short-term gratification and a higher risk of a more intensive social-networks use [34]. For the compensatory approach, the behavior itself, such as gaming, has been investigated as dysfunctional coping strategy [35–39]. Similar assumptions can also be strengthened for pornography use and compulsive buying; Efrati and Amichai-Hamburger [40] illustrate that pornography use as a compensation strategy is related with emotionally unsatisfied social needs which can result in a high frequent use. Ching, Tang [41] showed the relationship between compulsive buying and mood compensation in female participants. Beyond the circumstance that the behavior itself may be considered a coping strategy, further studies emphasize that general dysfunctional, avoidant coping strategies are a risk factor for all types of specific Internet use disorders [e.g., 42–47].

Keeping this in mind, the contemporary consideration of the actual experience of gratification and compensation in the moment of using an application, even retrospectively reported, seems to be missing so far,

not only in the context of addictive behaviors but also in the context of general online behaviors. The aim of the current study is the development of two questionnaires that capture the experience of gratification and the experience of compensation while using online applications. Even though both constructs are associated with each other, we decided to develop two questionnaires. The basis is that the experience of gratification is primarily about achieving a certain experience or emotional state. This in turn also corresponds more specifically to mechanism of positive reinforcement. The experience of compensation is about the reduction of deficits or negative emotions in the sense of negative reinforcement. This different conception thus also has an impact on the formulations of instructions and the items of the questionnaires. The formulations of the questionnaires are certainly not detached from each other but are analyzed independently.

Therefore, three studies are presented. In the first study, an exploratory approach was used to derive the factor structures of the "Experience of Gratification Scale" (EGS) and the "Experience of Compensation Scale" (ECS). Subsequently, both were tested confirmatory within a second sample. Based on these findings, relationships between the scales and the specific factors and further addiction-related constructs (e.g., experienced craving, use expectancies, symptom severity, impulsivity) were determined in a third step. We assumed significant correlations between the EGS, and ECS, and tendencies towards a problematic behavior, subjective craving, and use expectancies. We also hypothesized that impulsivity, depression, stress perception, and positive and negative mood are significantly related with EGS and ECS. Moreover, first differences between specific online activities and the amount of EGS and ECS were investigated.

2. Study 1: exploration of the factor structure

In the first study, we conducted exploratory factor analyses (EFA), both for the proposed EGS and ECS, giving insights into the empirical composition of both constructs.

2.1. Methods

2.1.1. Participants

In this study, 181 participants (121 females, 60 males) aged between 18 and 67 years ($M = 27.65$, $SD = 9.49$) have been included. All participants mentioned to use the Internet regularly. Regarding the specific online behaviors, social networks have been used by most of the participants ($n = 173$; 95.58%) followed by online buying-shopping ($n = 138$; 76.24%), online pornography ($n = 72$; 39.78%), online games ($n = 47$; 25.97%), and online gambling ($n = 14$; 7.73%).

The recruitment of the first study was hosted and conducted at the University of Duisburg-Essen. The study has been approved by the local ethics committee. All participants gave voluntary informed consent.

2.1.2. Scale developments of the EGS and ECS

For the development of the first draft of the questionnaires, five motives and needs were identified, which are associated with the use of online applications: social belongingness, hedonism, power, self-esteem enhancement, autonomy. These motives and needs served as a basis for developing items that explicitly ask the experiences of satisfying or compensation of the motives and needs in the moment of using the application (in contrast to items typically assessing general using motives). Various applications for specific online behaviors (gaming, gambling, online pornography, online buying-shopping, social networks, others) and associated definitions of the behaviors were presented in advance. Participants were asked to choose their favorite activity on the Internet. For the EGS, participants were asked to response to all items related to their favorite activity on the Internet. A total of 27 items target the corresponding experiences and satisfaction of needs, which are experienced and gratified by the use (e.g., While using social networks, I feel powerful). For the ECS, participants were asked that due to the use of the specific applications, they cope with or compensate for those unsatisfied feelings or needs. Therefore, mirrored 26 items were formulated for the compensation experience (e.g., While using social networks, I feel less powerless). In addition to the mirrored wording of the items (I feel powerful vs. I feel less powerless), especially the instructions differ. For the EGS, participants should imagine the experience of using a specific application (e.g., gaming); for ECS, they should imagine the experience of using a specific application right now compared to other activities or when the Internet is not used. Each item was rated on a 5-point Likert scale from 1 = never to 5 = very often (see Appendix A).

2.1.3. Statistical analysis

We used exploratory factor analysis (EFA) with principal axis factoring, promax rotation, and parallel analysis by Horn [48] to investigate the first facture structure for the EGS and ECS. Cronbach's alpha (α) was used measuring the reliability with coefficients. The analyses were conducted by using IBM SPSS statistics (version 27) for Mac.

We also controlled for careless responding. We used the long-string method, even-odd methods, Mahalanobis distance, and response times [49,50]. In addition, incomplete datasets have been excluded.

2.2. Results

We conducted two EFAs, each for the EGS and ECS. In both analyses, items were discarded due to low main loadings or high secondary loadings. For the EGS, it resulted in a three-factorial solution: social belonging (4 items; main loadings ≥0.748, secondary loadings ≤0.101; Cronbach's α = 0.892), autonomy/power (6 items; main loadings ≥0.547, secondary loadings ≤0.141; Cronbach's α = 0.804), and hedonism (4 items; main loadings ≥0.534, secondary loadings ≤0.167; Cronbach's α = 0.691) by excluding 13 items. For the ECS, a two-factorial solution has been found: self-esteem enhancement/social belonging (6 items; main loadings ≥0.568, secondary loadings ≤0.080; Cronbach's α = 0.869), and experience of relief from negative feelings (4 items; main loadings ≥0.872, secondary loadings ≤0.157; Cronbach's α = 0.813) by excluding 16 items. The descriptive values are shown in Appendix A.

2.3. Summary

With this first approach we examined the EGS and ECS; and differentiated specific factors for both scales. Overall, 14 items left to represent EGS, and ten items left representing ECS. However, due to the small sample size and the heterogeneous distribution of favorite activities, the results must be interpreted with caution. However, the results served as an initial baseline for a first item selection/exclusion and to get an initial idea of the potential dimensional structure of questionnaires.

3. Study 2: validation of the factor structures

We aimed to validate and examine the factor structures of the EGS and ECS in a larger and more balanced sample regarding the specific online behaviors using confirmatory factor analyses. For this purpose, the data of two datasets have been aggregated (dataset 1 $N = 667$, dataset 2 $N = 391$). The detailed procedure of each study can be found in Appendix B.

3.1. Methods

3.1.1. Participants

For the current analyses, 1058 participants (319 females, 348 males, for 391 no data regarding gender available) aged between 18 and 69 years ($M = 40.74$, $SD = 13.32$) have been analyzed. All participants mentioned to use the Internet regularly. For the screening and assignment to a specific online behavior, participants were either asked to

choose their favorite online application (dataset 1) or to choose the online behavior they would like to self-regulate mostly (dataset 2). Since the use of social networks and online buying-shopping were over-represented in the aggregated dataset, a random sample was selected for both applications. In summary, 287 participants (27.13%) received the questionnaire with instructions for online games, 301 participants (28.45%) for online buying-shopping, 299 participants (28.26%) for social networks, 148 participants (13.99%) for online pornography, and only 23 participants (2.17%) for online gambling.

The recruitment of the convenient samples was done via an access panel service provider. The study has been approved by the local ethics committee. All participants gave voluntary informed consent.

3.1.2. Statistical analysis

Confirmatory factor analyses (CFA) were conducted for the validation of the questionnaires. We evaluated the model fit of the CFAs with the standard criteria: Standardized Root Mean Square Residual (SRMR) and Root Mean Square Error of Approximation (RMSEA), whereas values <0.08 indicate a good fit with the data; Comparative Fit Index (CFI) and Tucker-Lewis fit index (TLI), whereas values >0.95. indicate a good fit with the data [51]. Additionally, a Chi-Square value divided by the degrees of freedom (χ^2/df) < 3 indicates an acceptable model fit [52]. Cronbach's alpha (α) was used measuring the reliability with coefficients. The CFAs were run with Mplus version 8.4 [53]. Again, we controlled for careless responding (similar to Section 2.1.3).

3.2. Results

3.2.1. Confirmatory factor analyses

We tested the three-factorial structure of the EGS. The fit indices showed only a poor fit between the models and the data (χ^2/df = 11.05, CFI = 0.909, TLI = 0.888, RMSEA = 0.098, SRMR = 0.054). The first factor "social belonging" was well represented by four items, which was valid for the second factor "autonomy/power" (6 items) and the third factor "hedonism" (4 items). Again, the coefficients illustrated a good representation of the factors by the items (see Table 1).

We also conducted the CFA for the two-factorial structure of the ECS. The fit indices indicated mostly an acceptable fit between the model and the data, except the RMSEA which is problematic high (χ^2/df = 16.79, CFI = 0.928, TLI = 0.904, RMSEA = 0.122, SRMR = 0.046). The first factor "self-esteem enhancement/social belonging" was well-represented by the six items. For the representation of the second factor "experience of relief from negative feelings" (4 items), the factor loadings were mostly convincing (see Table 2).

The results of the CFAs were promising, although the fit indices were not optimal (e.g., RMSEA). The factor structure of both scales showed only an acceptable fit with the data. We decided to re-consider whether a better representation of the construct experiencing of gratification and experiencing of compensation is possible by modifying the factor structures but also by excluding further items.

Table 1
Results of the CFA for the EGS (Experience of Gratification Scale) in the overall sample including the descriptive values, factor loadings (and residual covariances) sorted by factor loadings.

	*M (SD)**	*Range*	Factor 1	Factor 2	Factor 3
While using a [specific application], I …					
04 feel understood by others	1.70 (1.24)	0–4	0.869 (0.244)		
09 feel close to others	1.65 (1.27)	0–4	0.864 (0.253)		
12 feel supported by others	1.58 (1.25)	0–4	0.861 (0.259)		
02 feel belonging to others	1.73 (1.25)	0–4	0.836 (0.302)		
13 experience myself as influential	1.42 (1.22)	0–4		0.784 (0.385)	
05 feel successful	1.96 (1.21)	0–4		0.779 (0.394)	
08 feel powerful	1.25 (1.21)	0–4		0.750 (0.438)	
07 experience myself as actively creating	2.12 (1.20)	0–4		0.711 (0.494)	
11 feel independent	2.14 (1.18)	0–4		0.608 (0.630)	
03 feel self-reliant	2.33 (1.13)	0–4		0.588 (0.654)	
10 feel satisfied	2.25 (1.22)	0–4			0.799 (0.361)
14 feel pleasantly aroused	1.85 (1.33)	0–4			0.706 (0.501)
01 feel good	2.82 (0.84)	0–4			0.655 (0.571)
06 experience fun	2.95 (0.93)	0–4			0.638 (0.593)
Cronbach's α			0.918	0.850	0.774

* Note. *M* = mean values, *SD* = standard deviation.

Table 2
Results of the CFA for the ECS (Experience of Compensation Scale) in the overall sample including the descriptive values, factor loadings (and residual covariances) sorted by the factor loadings.

	M (SD)	*Range*	Factor 1	Factor 2
While using a specific application, I …				
08 feel less powerless	1.25 (1.24)	0–4	0.871 (0.241)	
07 feel less unsuccessful	1.34 (1.28)	0–4	0.860 (0.260)	
05 feel less insecure	1.45 (1.30)	0–4	0.846 (0.284)	
03 feel less useless	1.28 (1.29)	0–4	0.836 (0.301)	
02 feel less excluded	1.50 (1.25)	0–4	0.760 (0.423)	
10 feel less lonely/alone	1.60 (1.33)	0–4	0.774 (0.400)	
06 feel less worried	1.80 (1.29)	0–4		0.815 (0.336)
04 feel less constricted	1.60 (1.29)	0–4		0.805 (0.352)
09 feel less tense	2.07 (1.24)	0–4		0.710 (0.496)
01 feel less stressed	2.49 (1.06)	0–4		0.481 (0.769)
Cronbach's α			0.930	0.830

3.2.2. Theoretical evaluation and proposal of alternative factor structures

For the EGS, the findings illustrate that on the one hand, those certain needs, such as the need for belonging, autonomy, and power, are satisfied by the online activity. Additionally, we assume, on the other hand, that hedonistic and positive experiences also contribute to the general basic gratification experiences, which is in line with the Self-Determination Theory [9–11]. Moreover, the construct of experienced compensation is not defined by the absence of need satisfaction, but rather a lack of need satisfaction in daily life that individuals wish to reduce and compensate for by using specific online applications. Basic needs thus remain but the lack of fulfilment in daily life must be compensated for. The second factor is also not concerned with absence of fun, joy, and positive experiences, but with dealing with stress, worry, and uncertainty [see for example 16]. This assumption is in line with Müller and Wölfling [14], who also outlined that the experience of negative feelings can lead to compensation by using specific online applications.

These theoretical considerations lead to a critical reflection on the previous factor structures, which both address them but still do not adequately represent them. Even though the two scales can be considered as independent, they are related to each other, which in the best case is also reflected in the factor structure of each scale. Therefore, the items of both scales were subjected to a critical examination to adopt a two-factor solution for EGS, including gratification of needs and experience of pleasure and a two-factor solution of ECS as well as including compensation of needs and experience of relief from negative emotions.

3.2.3. Examination of the alternative factor structures

We tested the alternative two-factor structures for EGS and ECS. For both analyses, the fit indices showed a good fit with the data (EGS: χ^2/df

= 7.48, CFI = 0.972, TLI = 0.948, RMSEA = 0.078, SRMR = 0.029; ECS: χ^2/df = 5.76, CFI = 0.991, TLI = 0.984, RMSEA = 0.067, SRMR = 0.017). Moreover, both two-factor solutions were well-represented by the items used, which has been indicated by the factor loadings. The factor loadings and residual covariances for EGS are shown in Fig. 1a and for ECS in Fig. 1b.

To control the factor structure, we tested a one-factorial solution for EGS and ECS with all items loading on one factor. Overall, the model showed no good model fit for the EGS (χ^2/df = 40.13, CFI = 0.811, TLI = 0.685, RMSEA = 0.192, SRMR = 0.972); but mostly acceptable model fit for the ECS (χ^2/df = 21.00, CFI = 0.959, TLI = 0.932, RMSEA = 0.138, SRMR = 0.028). For this reason, the two-factor solutions were preferred.

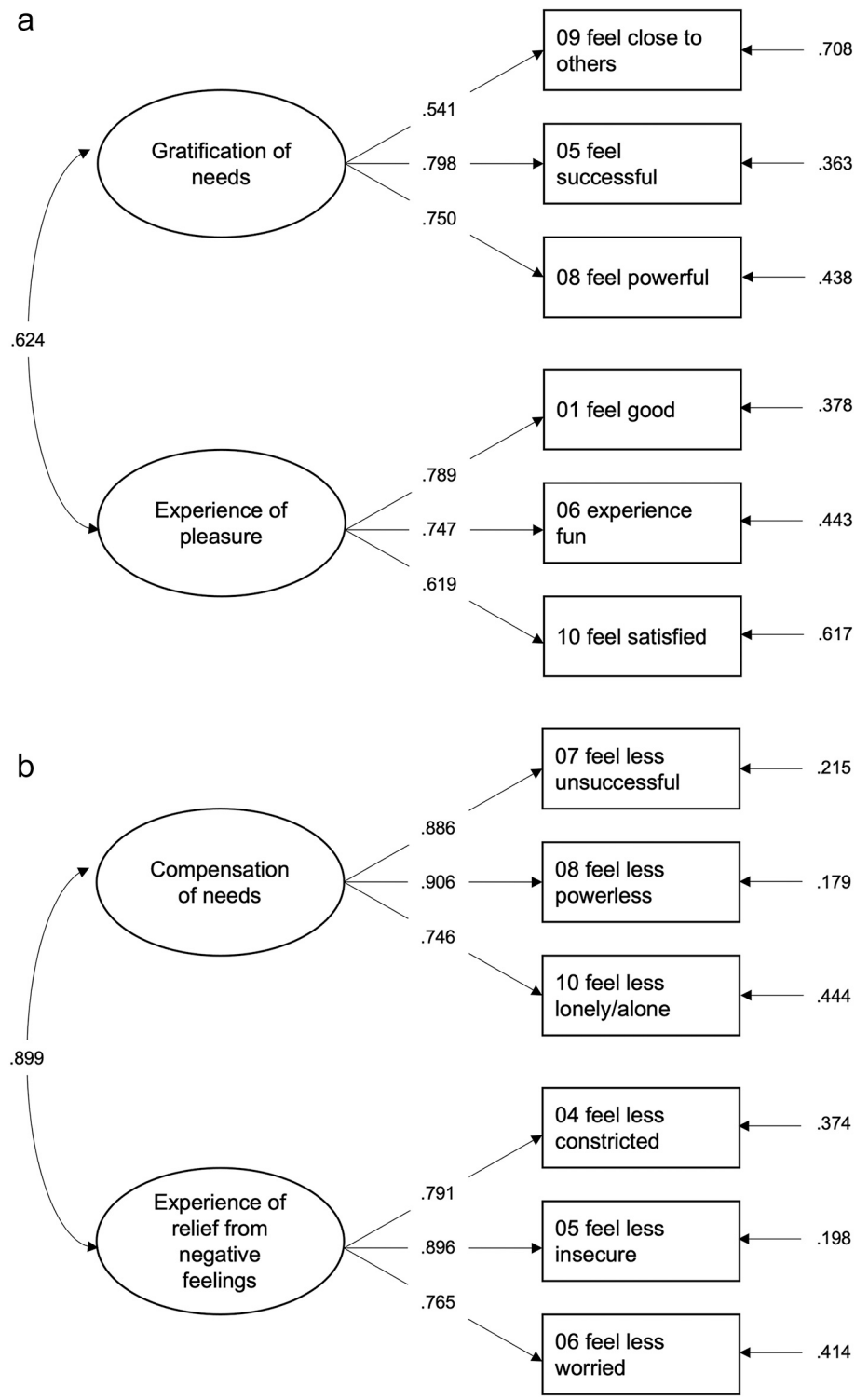

Fig. 1. a. Factor loadings and residual covariance of the alternative factor structure for EGS in the overall sample.
b. Factor loadings and residual covariance of the alternative factor structure for ECS in the overall sample.
Note. Values represent standardized factor loadings, factor covariances, and residual covariances. All estimates were significant $p \leq .010$.

3.3. Summary

The empirical findings indicated that for both scales, the EGS and ECS, a two-factor structure could be found. The theoretical re-evaluation of the construct as well as the proposal of alternative factor structures showed the best theoretical and empirical fit with the data. For the EGS, the gratification of needs and experience of pleasure were determined, each factor represented by three items. Compensation of needs as well as experience of relief from negative emotions, represented by three items for each factor, were examined for the ECS.

4. Study 3: investigation the construct validity

As a measure of the construct validity, we investigate the relationship between related constructs such as specific symptom severity, use expectancies, craving experiences, impulsivity, depression, perceived stress, positive as well as negative affect and the EGS and ECS for the overall sample as well as for the different online activity.

4.1. Methods

4.1.1. Participants

In the third study, 993 participants (496 females, 497 males) with a mean age of 42.96 years (*SD* = 14.05, *Range*: 18–65) have been included. All participants mentioned to use the Internet regularly. At the beginning, they were asked to specify their most-preferred online application, declared as "first-choice"-application, where they could choose between gaming, online buying-shopping, online pornography-use, social-networks use, and gambling. Participants who indicated "other" were excluded from further analyses. Six hundred sixty-seven participants were already included in the analyses of Study 2. In total, 458 users (46.12%) indicated social-networks use as their first-choice application, followed by online buying-shopping (n = 317, 31.92% of the participants), gaming (n = 168, 16.92% of the participants), online pornography use (n = 27, 2.72% of the participants) and gambling (n = 23, 2.32% of the participants).

The recruitment of the convenient samples was done via an access panel service provider. The study has been approved by the local ethics committee. All participants gave voluntary informed consent.

4.1.2. Further questionnaires

In addition to the EGCS, further questionnaires were also implemented. Specific versions of the short Internet Addiction Test were used to measure symptom severity of different types of Internet use disorders; in addition to the overall sum score, it also includes the subscales "loss of control/time management" and "craving/social problems [54–57]. Modified versions of the Internet Use Expectancies Scale were used to measure "positive expectancies" and "avoidance expectancies" [44]. Craving experiences were assessed with the Craving Assessment Scale for Behavioral Addictions [58]. All these questionnaires were specified for the different applications and participants received the version adapted for gaming, online buying-shopping, online pornography use, social-networks use, or online gambling based on their first-choice-application. A definition of the online application was presented in the instructions of each questionnaire.

We assessed impulsivity by using the UPPS-P Impulsive Behavior Scale [59,60] including the subscales "negative urgency", "premediation", "perseverance", "sensation seeking", and "positive urgency". Depression severity was measured by the Patient Health Questionnaire [61]. Due to the online character of the study, the item assessing suicidality was excluded. The short version of the Perceived Stress Questionnaire [62] was used, which includes the subscales "Worries", "Tension", "Joy", "Demands", and the overall scores for perceived stress in daily life. Assessing "positive" and "negative experiences" of the participants, the short form of the Positive and Negative Affect Schedule [63] was used.

4.1.3. Statistical analysis

The statistical analyses were carried out with IBM SPSS statistics (version 27) for Mac. Pearson correlations were used to test the bivariate correlations between the variables. According to Cohen [64], correlation coefficient $r \geq 0.010$ indicates a small, $r \geq 0.030$ indicates a medium, and $r \geq 0.050$ indicates a large effect. We used ANOVA including post-hoc analysis with Bonferroni corrections for investigating group differences between the different online activities. For evaluation the effect, $\eta_p^2 \geq 0.010$ indicates a small, $\eta_p^2 \geq 0.060$ a medium, and $\eta_p^2 \geq 0.140$ a large effect [64]. We controlled for careless responding (similar to Section 2.1.3).

4.2. Results

4.2.1. Correlation analyses in the overall sample

The descriptive values and bivariate correlations between the variables mentioned for the overall sample are shown in Table 3. The EGS and ECS overall mean scores and factors significantly correlated with each other, as well as with symptom severity, use expectancies, and craving experiences, showing medium to high effect sizes. Moreover, there were also significant correlations with small to medium effect sizes between most variables assessing impulsivity, stress perception, affect, and the EGS, and ECS.

The overall scores were significant correlated ($r = 0.558$, $p \leq .001$). The bivariate correlations between the EGS and ECS factors showed significant relationship with medium to large effect sizes. Fisher's Z comparisons of correlation coefficients in one sample indicates significant differences between the EGS factors and experience of relief from negative feelings ($z = 2.55$, $p \leq .001$) and the ECS factors and gratification of needs ($z = 5.10$, $p \leq .001$). The other comparisons were non-significant (p's ≥ 0.160).

In addition, one-factorial variance analyses were calculated to test whether there were significant differences between non-problematic, problematic, and pathological users regarding the experienced gratification and experienced compensation. The results highlight that all three groups were significantly different from each other, with problematic users having significantly higher scores than non-problematic users and pathological users having significantly higher scores than both non-problematic and problematic users in both experienced gratification and experienced compensation (for detailed analyses see Appendix C).

4.2.2. Investigation the effects for different online activities

The descriptive values of the samples separated by the favorite online activity are shown in Table 4. We also examined significant differences between the online activities regarding the EGS and ECS variables.

The relationships between the constructs were also examined for gaming, online buying-shopping, and social-networks use (see Table 5). For pornography use and gambling, the sample sizes were considered too small for bivariate correlation analyses.

4.3. Summary

Overall, the findings illustrate significant relationships between the EGS and ECS factors and addiction-related features such as symptom severity, craving experiences, and use expectancies. It was shown that symptom severity was positively related to all gratification and compensation factors highlighting the association of both constructs. We also found significant differences in the experienced gratification as well as experienced compensation between non-problematic, problematic, and pathological users. Use expectancies and craving experiences have also been differentiated in positive expectancies and avoidance as well as obsessive/wanting craving, relief/reward craving and physiological craving experiences. The results outline that positive and avoidance expectancies as well as craving experiences were associated with EGS and ECS as well. Moreover, both scales also showed significant

Table 3
Bivariate Correlations between the factors of both scales EGS and ECS and the applied scales.

				EGS Overall mean score	Gratification of needs	Experience of pleasure	ECS Overall mean score	Compensation of needs	Experience of relief from negative feelings
	N = 993	*M (SD)*		2.06 (0.78)	1.66 (0.94)	2.46 (0.80)	1.47 (1.06)	1.37 (1.12)	1.56 (1.12)
			Range	0–4	0–4	0–4	0–4	0–4	0–4
	Gratification of needs			0.909**			0.593**		
	Experience of pleasure			0.872**	0.588**		0.386**		
	Compensation of needs			0.549**	0.603**	0.355**	0.945**		
	Experience of relief from negative emotions			0.507**	0.518**	0.374**	0.945**	0.788**	
Symptom Severity	Sumscore	25.72 (10.76)	12–60	0.466**	0.497**	0.320**	0.580**	0.567**	0.529**
	Loss of Control/Time Management	13.89 (5.66)	6–30	0.433**	0.461**	0.298**	0.529**	0.524**	0.476**
	Craving/Social Problems	11.83 (5.60)	6–30	0.458**	0.488**	0.315**	0.579**	0.558**	0.536**
Use Expectancies	Positive expectancies	4.21 (1.05)	1–6	0.707**	0.562**	0.712**	0.436**	0.409**	0.415**
	Avoidance expectancies	2.88 (1.26)	1–6	0.493**	0.525**	0.339**	0.639**	0.617**	0.591**
Craving Experiences	Wanting Craving	1.17 (1.33)	0–5	0.515**	0.541**	0.364**	0.569**	0.569**	0.506**
	Relief/Reward Craving	1.89 (1.37)	0–5	0.626**	0.556*	0.561**	0.625**	0.586**	0.595**
	Physiological Craving	1.80 (1.42)	0–5	0.613**	0.552**	0.542**	0.607**	0.575**	0.573**
Impulsivity	Negative Urgency	1.94 (0.65)	1–4	0.228**	0.264**	0.132**	0.411**	0.408**	0.370**
	Premediation	2.99 (0.58)	1–4	−0.016	−0.072*	0.054	−0.075*	−0.094**	−0.049
	Perseverance	3.09 (0.59)	1–4	−0.109**	−0.148**	−0.038	−0.273**	−0.283**	−0.233**
	Sensation Seeking	2.15 (0.74)	1–4	0.296**	0.310**	0.211**	0.222**	0.216**	0.204**
	Positive Urgency	1.78 (0.69)	1–4	0.275**	0.326**	0.152**	0.449**	0.449**	0.401**
	Depression	1.88 (0.70)	1–4	0.237**	0.250**	0.167**	0.472**	0.454**	0.438**
Stress Perception	Overall score	49.36 (5.16)	35–70	0.215**	0.218**	0.162**	0.113**	0.126**	0.088**
	Worries	42.20 (14.03)	0–100	0.275**	0.303**	0.178**	0.264**	0.275**	0.224**
	Tension	50.47 (11.14)	20–93.33	0.155**	0.116**	0.163**	0.202**	0.170**	0.213**
	Joy	38.40 (22.77)	0–100	0.235**	0.226**	0.191**	0.399**	0.371**	0.384**
	Demands	43.19 (14.88)	13.33–93.33	0.283**	0.275**	0.225**	0.367**	0.355**	0.340**
Affect	Positive Affect	2.70 (0.78)	1–5	0.261**	0.262**	0.198**	0.118**	0.116**	0.107**
	Negative Affect	1.62 (0.81)	1–4.90	0.255**	0.307**	0.135**	0.441**	0.444**	0.390**

* $p \leq .050$.
** $p \leq .010$.

Table 4
Descriptive values (*M, SD, Range*) and group comparison for the sample descriptions, EGS, and ECS of the specific online activities.

	Gaming (n = 168)		Buying-shopping (n = 317)		Social-networks use (n = 458)		Pornography use (n = 27)		Gambling (n = 23)		Group comparisons
Age	41.22 (14.22)	18–64	46.56 (13.34)	18–65	41.36	18–64	37.30 (11.60)	19–61	44.48 (14.78)	24–65	$F(981,4) = 8.71$, $p \leq .001$, $\eta_p^2 = 0.034$ [1]
Gender (f/m/d)	66/102/0		179/138/0		241/217/0		4/23/0		6/17/0		–
EGS: Overall score	2.38 (0.75)	0.67–4	1.73 (0.88)	0–4	2.13 (0.62)	0.17–4	2.43 (0.70)	1.17–3.67	2.35 (0.81)	*0.83–4*	$F(981,4) = 27.28$, $p \leq .001$, $\eta_p^2 = 0.099$ [2]
EGS: Gratification of needs	1.97 (1.03)	0–4	1.25 (0.98)	0–4	1.83 (0.74)	0–4	1.41 (1.18)	0–3.33	1.97 (0.99)	*0.33–4*	$F(988,4) = 27.25$, $p \leq .001$, $\eta_p^2 = 0.099$ [3]
EGS: Experience of pleasure	2.79 (0.65)	1–4	2.21 (0.95)	0–4	2.44 (0.66)	0–4	3.46 (0.52)	2.33–4	2.72 (0.83)	*1.33–4*	$F(988,4) = 28.52$, $p \leq .001$, $\eta_p^2 = 0.104$ [4]
ECS: Overall score	1.63 (1.17)	0–4	1.22 (1.07)	0–4	1.58 (0.94)	0–4	1.27 (1.19)	0–3.67	1.67 (1.30)	*0–3.83*	$F(988,4) = 7.31$, $p \leq .001$, $\eta_p^2 = 0.029$ [5]
ECS: Compensation of needs	1.54 (1.25)	0–4	1.05 (1.13)	0–4	1.54 (0.98)	0–4	1.24 (1.27)	0–3.67	1.59 (1.31)	*0–4*	$F(988,4) = 11.03$, $p \leq .001$, $\eta_p^2 = 0.043$ [6]
ECS: Experience of relief from negative emotions	1.72 (1.19)	0–4	1.40 (1.17)	0–4	1.63 (1.01)	0–4	1.31 (1.23)	0–4	1.75 (1.35)	*0–4*	$F(988,4) = 3.51$, $p = .007$, $\eta_p^2 = 0.014$ [7]

[1] Post-hoc analysis indicates significant differences between buying-shopping and gaming, social-networks use, and pornography use.
[2] Overall EGS mean; post-hoc analysis indicates significant differences between buying-shopping and all other activities, as well as between social-networks use and gaming.
[3] Post-hoc analysis indicates significant differences between buying-shopping and gaming, social-networks use, pornography use, and gambling; as well as differences between gaming and pornography use.
[4] Post-hoc analysis indicates significant differences between all online activities, except between gambling and gaming as well as social-networks use.
[5] Overall ECS mean; post-hoc analysis indicates significant differences between buying-shopping and gaming as well as social-networks use.
[6] Post-hoc analysis indicates significant differences between buying-shopping and gaming as well as social-networks use.
[7] Post-hoc analysis indicates significant differences between buying-shopping and gaming as well as social-networks use.

correlations with impulsivity, depression, perceived stress, as well as positive and negative effect, even if those constructs are more generic related to addictive tendencies.

In addition, we also investigated the relevance of EGS and ECS when controlling for the specific online activities. Results highlighted significant differences of all factors in gaming, buying-shopping, social-networks use, pornography use, and gambling. Post-hoc analyses indicated that, in general, the experienced gratification and experienced compensation was significantly lower in buying-shopping than in the other online activities. However, further research is needed to examine systematic differences in the importance and experience of each component for each activity. This is also accompanied by, in principle, significant correlations between EGS, ECS, and the proposed constructs (symptom severity, use expectancies, craving experiences, impulsivity, perceived stress, depression, and affect), which could also be determined for the activities gaming, buying-shopping and social networks. However, initial indications regarding the effect sizes of the correlation coefficients suggest differences in the strength of the correlations. Again, further research would be necessary to examine whether there are systematic differences in the significance of individual factors depending on the specific online activity.

5. General discussion

The aim of the current study was to develop two questionnaires measuring experienced gratification and experienced compensation due to the use of specific online applications, for example, gambling, pornography-use, online buying-shopping, social-networks use, and gambling. The results of each study allowed a gradual, verifying, and systematic approach to theoretically justified factor structures. For the EGS, the two factors "gratification of needs" and "experience of pleasure" were found. Mirrored to this, for the ECS, the two-factor solution consisting of the "compensation of needs" and "experience of relief from negative feelings" resulted.

The respective two-factorial structures of the EGS and ECS, which mirror each other, integrate well with the theoretical assumptions. Both constructs are not independent but complement each other, which was aimed when re-considering the factor structures. The first factors (gratification of needs and compensation of needs) are characterized by the focus on individual needs such as social belonging, autonomy, and power. The use of certain applications is intended to gratify these needs or compensate for the lack of gratification in real life. The same systematic approach is reflected in the second factors as well (experience of pleasure and experience of relief from negative feelings): while the aim is to actually have positive, hedonistic experiences through the engagement in specific online behaviors, negative emotions, stress, and worry are compensated for. The factor solutions fit within different theoretical models of addiction frameworks such as the experiences of gratification and compensation in the I-PACE model [8], but also other approaches representing a general functional behavior such as the Uses and Gratification approach [13] and the model by Lazarus and Folkman [16].

However, this theory-driven approach and the critical revalidation of the factor structures by the second CFAs must, of course, be sustained by methodological and statistical testing. The current approach is mainly related to the context of addiction, however, it could be also integrated and discussed against the background of a general functional online behavior as it has been done previously considering a motivational or coping perspective [e.g., 29,34,35,40]. The addiction-related context is also emphasized by the correlations between the EGS and ECS and symptom severity of the specific behaviors as well as further related constructs (e.g., craving experiences, use expectancies). The findings show the relationship between experiences of gratification, experiences of compensation, and further constructs which are also discussed as relevant for the development and maintenance of addictive behaviors. These correlations illustrate that the different constructs such as craving experiences and use expectancies could be associated with the experience during a specific behavior. The correlations could potentially provide a first approach to better understand the maintenance and emergence mechanisms of problematic usages. These relationships refer to the total sample, but - despite group differences in the experienced gratification and experienced compensation between the different activities - they are also reflected in subsamples. It might be a first indication that the correlation patterns may not be different across behaviors such as gaming, buying-shopping, or social networking. However, considering the comparison of the EGS and ECS between all

Table 5
Bivariate Correlations between the factors of both scales EGS and ECS and the applied scales differentiated for gaming, buying-shopping, and social-networks use.

		M (SD)	*Range*	EGS Overall mean	Gratifi-cation of needs	Experience of pleasure	ECS Overall mean	Compen-sation of needs	Experience of relief from negative feelings
Gaming	Gratification of needs			0.930**			0.583**		
	Experience of pleasure			0.812**	0.544**		0.268**		
	Compensation of needs			0.499**	0.579**	0.211**	0.961**		
	Experience of relief from negative emotions			0.533**	0.540**	0.295**	0.957**	0.841	
Symptom Severity	Sum score	28.23 (11.02)	12–60	0.467**	0.510**	0.258**	0.627**	0.589**	0.614**
	Loss of Control/Time Management	15.00 (5.36)	6–30	0.400**	0.443**	0.210**	0.580**	0.548**	0.564**
	Craving/Social Problems	13.23 (6.05)	6–30	0.496**	0.536**	0.284**	0.627**	0.586**	0.617**
Use Expectancies	Positive expectancies	4.69 (0.91)	1.50–6	0.692**	0.563**	0.690**	0.385**	0.351**	0.389**
	Avoidance expectancies	3.13 (1.42)	1–6	0.558**	0.611**	0.307**	0.674**	0.653**	0.639**
Craving Experiences	Wanting Craving	1.51 (1.56)	0–5	0.503**	0.563**	0.258**	0.615**	0.608**	0.572**
	Relief/Reward Craving	2.39 (1.40)	0–5	0.617**	0.591**	0.475**	0.644**	0.604**	0.632**
	Physiological Craving	2.28 (1.54)	0–5	0.583**	0.574**	0.423**	0.627**	0.592**	0.611**
Impulsivity	Negative Urgency	1.98 (0.70)	1–3.80	0.254**	0.312**	0.084	0.442**	0.443**	0.404**
	Premediation	2.93 (0.63)	1–4	−0.042	−0.115	0.087	−0.137	−0.136	−0.127
	Perseverance	3.01 (0.58)	1.40–4	−0.124	−0.161**	−0.028	−0.350**	−0.344**	−0.326**
	Sensation Seeking	2.22 (0.77)	1–4	0.494**	0.515**	0.312**	0.315**	0.313**	0.291**
	Positive Urgency	1.83 (0.75)	1–4	0.289**	0.348**	0.108	0.485**	0.499**	0.430**
	Depression	1.89 (0.75)	1–4	0.187*	0.210**	0.095	0.432**	0.414**	0.415**
Stress Perception	Overall score	50.01 (5.53)	38.33–70	0.430**	0.367**	0.401**	0.288**	0.272**	0.281**
	Worries	43.21 (16.46)	6.67–100	0.334**	0.318**	0.258**	0.348**	0.338**	0.331**
	Tension	50.60 (11.02)	20–80	0.219**	0.135	0.288**	0.145	0.108	0.172*
	Joy	37.46 (22.14)	0–100	0.149	0.147	0.106	0.323**	0.296**	0.324**
	Demands	43.69 (15.28)	13.33–86.67	321**	0.305**	0.250**	0.405**	0.283**	0.396**
Affect	Positive Affect	2.75 (0.83)	1.10–5	0.416**	0.379**	0.350**	0.275**	0.268**	0.260**
	Negative Affect	1.72 (0.92)	1–4.90	0.216**	0.258**	0.086	0.367**	0.363**	0.341**
Buying shopping	Gratification of needs			0.917**			0.665**		
	Experience of pleasure			0.911**	0.670**		0.472**		
	Compensation of needs			0.613**	0.677**	0.438**	0.931**		
	Experience of relief from negative emotions			0.553**	0.566**	0.443**	0.936**	0.744**	
Symptom Severity	Sum score	22.66 (10.44)	12–58	0.559**	0.620**	0.398**	0.594**	0.586**	0.524**
	Loss of Control/Time Management	12.01 (5.29)	6–30	0.557**	0.599**	0.416**	0.567**	0.564**	0.496**
	Craving/Social Problems	10.64 (5.45)	6–29	0.531**	0.607**	0.359**	0.588**	0.576**	0.524**
Use Expectancies	Positive expectancies	3.81 (1.18)	1–6	0.718**	0.590**	0.724**	0.490**	0.453**	0.463**
	Avoidance expectancies	2.67 (1.22)	1–6	0.537**	0.594**	0.384**	0.642**	0.625**	0.576**
Craving Experiences	Wanting Craving	1.12 (1.38)	0–5	0.615**	0.687**	0.434**	0.605**	0.644**	0.488**
	Relief/Reward Craving	1.82 (1.46)	0–5	0.726**	0.683**	0.643**	0.649**	0.630**	0.584**
	Physiological Craving	1.70 (1.47)	0–5	0.720**	0.695**	0.619**	0.659**	0.635**	0.597**
Impulsivity	Negative Urgency	1.90 (0.67)	1–4	0.354**	0.409**	0.234**	0.481**	0.492**	0.409**
	Premediation	3.00 (0.60)	1–4	−0.016	−0.098	0.072	−0.023	−0.078	0.033
	Perseverance	3.15 (0.56)	1–4	−0.206**	−0.274**	−0.099	−0.307**	−0.321**	−0.254**
	Sensation Seeking	1.98 (0.71)	1–4	0.287**	0.288**	0.235**	0.242**	0.234**	0.218**
	Positive Urgency	1.77 (0.71)	1–4	0.406**	0.482**	0.255**	0.512**	0.525**	0.433**
	Depression	1.82 (0.72)	1–4	0.364**	0.380**	0.283**	0.523**	0.500**	0.478**
Stress Perception	Overall score	48.42 (5.05)	35–63.33	0.139*	0.155**	0.098	0.032	0.062	<0.001
	Worries		0–93.33	0.219**	0.294**	0.102	0.251**	0.271**	0.199**

(*continued on next page*)

Table 5 (*continued*)

		M (SD)	*Range*	EGS Overall mean	Gratifi-cation of needs	Experience of pleasure	ECS Overall mean	Compen-sation of needs	Experience of relief from negative feelings
		39.98 (14.17)							
	Tension	48.98 (10.96)	26–67–86.67	0.184**	0.141*	0.197**	0.238**	0.200**	0.244**
	Joy	36.78 (23.52)	0–100	0.294**	0.304**	0.231**	0.425**	0.399**	0.394**
	Demands	41.51 (14.34)	13.33–80	0.321**	0.320**	0.266**	0.312**	0.321**	0.263**
Affect	Positive Affect	2.67 (0.80)	1–4.90	0.152**	0.185**	0.092	0.071	0.074	0.058
	Negative Affect	1.61 (0.84)	1–4.80	0.388**	0.455**	0.250**	0.541**	0.550**	0.462**
Social-networks use	Gratification of needs			0.900**			0.473**		
	Experience of pleasure			0.870**	0.568**		0.356**		
	Compensation of needs			0.453**	0.473**	0.320**	0.943**		
	Experience of relief from negative emotions			0.439**	0.422**	0.352**	0.946**	0.784**	
Symptom Severity	Sum score	26.77 (10.19)	12–57	0.321**	0.311**	0.254**	0.508**	0.490**	0.470**
	Loss of Control/Time Management	14.85 (5.60)	6–30	0.283**	0.271**	0.228**	0.439**	0.429**	0.401**
	Craving/Social Problems	11.92 (5.23)	6–28	0.322**	0.316**	0.251**	0.520**	0.495**	0.488**
Use Expectancies	Positive expectancies	4.24 (0.90)	1–6	0.625**	0.492**	0.624**	0.395**	0.361**	0.385**
	Avoidance expectancies	2.92 (1.20)	1–6	0.393**	0.381**	0.311**	0.593**	0.563**	0.556*
Craving Experiences	Wanting Craving	1.01 (1.15)	0–4.67	0.412**	0.421**	0.303**	0.535**	0.523**	0.488**
	Relief/Reward Craving	1.68 (1.19)	0–5	0.523**	0.460**	0.466**	0.644**	0.603**	0.614**
	Physiological Craving	1.59 (1.24)	0–5	0.521**	0.479**	0.442**	0.602**	0.573**	0.563**
Impulsivity	Negative Urgency	1.95 (0.62)	1–4	0.081	0.090	0.051	0.318**	0.298**	0.302**
	Premediation	3.01 (0.56)	1–4	0.019	−0.031	0.071	−0.099*	−0.097*	−0.091
	Perseverance	3.08 (0.60)	1.40–4	0.005	−0.029	0.042	−0.210**	−0.220**	−0.177**
	Sensation Seeking	2.22 (0.73)	1–4	0.137**	0.148**	0.092	0.103*	0.089	0.106*
	Positive Urgency	1.75 (0.64)	1–3.75	0.148**	0.172**	0.085	0.370**	0.353**	0.347**
	Depression	1.90 (0.67)	1–4	0.109*	0.121**	0.069	0.415**	0.395**	0.389**
Stress Perception	Overall score	49.68 (4.98)	35–66.67	0.093*	0.106*	0.056	0.011	0.021	0.001
	Worries	43.00 (12.43)	13.33–86.67	0.206**	0.209**	0.152**	0.130**	0.143**	0.103*
	Tension	51.34 (11.33)	20–93.33	0.092*	0.076	0.088	0.179**	0.145**	0.192**
	Joy	39.62 (21.98)	0–100	0.222**	0.201**	0.192**	0.384**	0.351**	0.373**
	Demands	44.00 (14.78)	13.33–93.33	0.212**	0.208**	0.165**	0.340**	0.318**	0.323**
Affect	Positive Affect	2.69 (0.75)	1–5	0.287**	0.271**	0.236**	0.051	0.058	0.039
	Negative Affect	1.58 (0.73)	1–4.20	0.104*	0.154**	0.022	0.359**	0.366**	0.313**

* $p \leq .050$.
** $p \leq .010$.

five online activities, it may be worth investigating the behavior-specific experiences. It could be assumed that the experience of pleasure is more important, for example, in pornography use than in buying-shopping, whereas the experience of relief from negative emotions is more relevant in social-networks use than in other behaviors. These assumptions are based on preliminary findings in a non-clinical sample where the experienced gratification or experienced compensation is merely part of a functional behavior instead of an addictive behavior solely; therefore, we have the impression that both the experience of gratification and experience of compensation should be investigated. Thereby it could be possible to investigate a dualistic approach not for gratification and compensation solely but for positive and avoidance expectancies which also may illustrate the distinction between positive and negative reinforcement mechanisms in addiction.

We also found significant relationships with the EGS, ECS and other, more generic constructs that are associated with problematic use of online applications. In the I-PACE model, impulsivity, depression, negative mood, and stress vulnerability are defined as predisposing risk factors related with tendencies towards addictive behaviors, but also mediated by affective and cognitive components, internet-related cognitive biases, and gratification and compensation [8]. The relationship between these predisposing variables and the mediators are indicated, however, further conclusions as well as possible causal interpretations should be made by further studies.

With this study, we intended to develop questionnaires that take a theoretically founded approach to the constructs of actual (self-reported) experienced gratification and experienced compensation while using specific online applications. We thereby mainly focus on the integration in the addiction framework, which is however, not exclusively for both constructs which could be relevant in investigating general online behavior as well. The participants had to imagine these experiences rather than describing it when they are actually gaming, for example, which is a methodological limitation. Nevertheless, it seems to be more specific instead of measuring gratification and compensation indirectly by asking for general motives to engage in specific behaviors. Future studies may use the EGS and the ECS within an ambulatory momentary assessment to measure the experiences more directly while actually using the application. In addition, it would be important to investigate, whether needs and deficits are experienced and perceived in advance. For this purpose, we recommend to explicitly examine in future studies whether experienced gratification and experienced compensation are generally linked to basic need satisfaction and need frustration, as well as application-specific needs and motives. Moreover, Wegmann and Brand [4] postulate that specific needs and fears could result in the problematic use of social networks, however, the effect could be reinforced by positive, gratifying or fear-driven, compensatory mechanisms. The results of the individual correlations show first tendencies of similar patterns. Apart from a general relevance of the constructs for the different online activities, it would now be time to systematically address the specific characteristics of the online activities, for example 1) which specific needs (e.g., materialistic values, social belonging, sexual needs) are gratified by the specific behavior or 2) whether a lack of need satisfaction or negative emotions is compensated for. From a mental health and clinical perspective, a better understanding of the relevance of specific needs, desires, and the experienced gratification and compensation due to the use of the Internet may impact prevention and treatment. It could reveal which deficits or emotions are coped for in everyday life with the help of specific applications and in which cases persons do not develop any other coping strategy. Based on this, it would contribute to the understanding of reinforcement processes and thereby to the development of alternative activities in everyday life to break the “vicious cycle” that can lead to problematic use.

There are some further limitations to be mentioned. Overall, we used a non-clinical sample and even if the participants partly suggest experiencing first negative consequences in daily life, a validation of the questionnaire should be made in a clinical sample. However, the procedure is still valid since it could be assumed that clinical or treatment-seeking individuals do not experience positive feelings or the gratification of specific needs anymore. It must also be considered that a non-clinically validated questionnaire was used to assess symptom severity. However, previous studies have shown the usefulness of the s-IAT for mapping different types of online addictive behaviors, for e.g., social-networks use [43,56], gaming [65], pornography use [66–68], and online buying-shopping [57,69]. There may be other questionnaires that assess the individual usage patterns in a more clinically validated manner, but the usage of the modifications used here allows for greater comparability across the different applications using the same items. The gratification and compensation scales should be tested in clinical samples and using behavior-specific clinical interviews and screenings in future studies. Other factors such as socio-demographic characteristics or cultural inferences may also have different effects on the preference of the individual applications in the different samples, so that further studies are necessary. In addition, the factor structure of the different online behavior should be controlled in further studies. The model fits are partly only acceptable, and a further validation is highly needed.

6. Conclusion

With the three studies we developed two questionnaires that capture the experience of gratification and the experience of compensation by using different online applications. For both scales, we identified a two factorial solution including the gratification of needs and experience of pleasure for EGS and the compensation of needs and experience of relief from negative emotions for the ECS. The questionnaires allow the investigation of specific experiences within and between different types of potential online addictive behaviors. Future studies must validate the relevance of these constructs for different types of addictive behaviors as well as substance-use disorders in general, but also within the interplay of further addiction-related constructs such as craving experiences, use expectancies, inhibitory control, coping strategies, and further affective and cognitive processes.

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Declaration of interest

The authors declare no conflict of interest regarding the current manuscript.

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Appendix A. Overview of both questionnaires before item reduction

Table A.1
Descriptive values of EGS (Experience of Gratification Scale) including mean, standard deviation, range, skewness, and kurtosis for all items (including the original German translation) defined before the exploratory factor analysis (EFA).

Instructions:
Please mark which of the answer options applies most to you. There are no right or wrong answers; the important thing is that you rate each statement as it applies most to you.
While using [a specific application] , I …
(Bitte kreuzen Sie an, welche Ausprägung der Antwortmöglichkeit am ehesten auf Sie zutrifft. Es gibt keine richtigen oder falschen Nennungen; wichtig ist, dass Sie die Aussagen jeweils so beurteilen, wie es für Sie selbst am ehesten zutrifft. Während ich [eine bestimmte Online-Anwendung] nutze, …)

	M (SD)	*Range*	*Skewness*	*Kurtosis*
01 feel good (fühle ich mich gut)	2.82 (0.66)	1–4	−0.263	0.213
02 feel autonomous (fühle ich mich autonom)	2.43 (0.97)	0–4	−0.547	0.127
03 experience fun (erlebe ich Spaß)	2.78 (0.79)	0–4	−0.282	0.104
04 feel strong (fühle ich mich stark)	1.83 (0.98)	0–4	−0.054	−0.444
05 feel close to others (fühle ich mich anderen Menschen nah)	1.90 (1.18)	0–4	0.001	−0.934
06 feel acknowledged (fühle ich mich anerkannt)	1.67 (1.07)	0–4	−0.048	−0.886
07 feel pleasantly aroused (fühle ich mich angenehm erregt)	1.75 (1.11)	0–4	−0.072	−0.937
08 feel belonging to others (fühle ich mich anderen Menschen zugehörig)	1.96 (1.20)	0–4	−0.111	−0.872
09 feel admired (fühle ich mich bewundert)	1.07 (0.99)	0–4	0.744	0.185
10 feel successful (fühle ich mich erfolgreich)	1.57 (1.06)	0–4	0.002	−0.886
11 feel useful (fühle ich mich nützlich)	1.67 (1.06)	0–4	0.031	−0.679
12 feel self-reliant (fühle ich mich eigenständig)	2.32 (1.08)	0–4	−0.508	−0.330
13 consider myself to be assertive(erlebe ich mich als durchsetzungsfähig)	1.85 (1.08)	0–4	−0.184	−0.730
14 feel supported by others (fühle ich mich von anderen Menschen unterstützt)	1.88 (1.23)	0–4	−0.142	−1.00
15 feel satisfied (fühle ich mich befriedigt)	2.22 (1.02)	0–4	−0.348	−0.255
16 feel self-determined (fühle ich mich selbstbestimmt)	2.32 (0.99)	0–4	−0.474	−0.221
17 experience myself as influential (erlebe ich mich einflussreich)	1.65 (1.00)	0–4	0.076	−0.509
18 experience myself as actively creating (erlebe ich mich aktiv gestaltend)	2.07 (1.12)	0–4	−0.132	−0.802
19 feel accepted by others (fühle ich mich von anderen Menschen akzeptiert)	2.01 (1.19)	0–4	−0.203	−0.891
20 feel powerful (fühle ich mich mächtig)	1.15 (1.02)	0–4	0.444	−0.679
21 feel competent(fühle ich mich kompetent)	2.14 (1.03)	0–4	−0.384	−0.214
22 feel like intoxicated (fühle ich mich wie berauscht)	1.17 (1.10)	0–4	0.582	−0.589
23 feel independent (fühle ich mich unabhängig)	2.13 (1.14)	0–4	−0.150	−0.761
24 feel valuable (fühle ich mich wertvoll)	1.85 (1.09)	0–4	−0.066	−0.640
25 feel understood by others (fühle ich mich von anderen Menschen verstanden)	1.93 (1.12)	0–4	−0.181	−0.746
26 experience pleasure (erlebe ich Genuss)	2.13 (1.06)	0–4	−0.229	−0.617
27 feel important (fühle ich mich wichtig)	1.71 (1.01)	0–4	−0.153	−0.574

Note. At the beginning of the survey, all participants chose their favorite online activity (gaming, gambling, buying-shopping, pornography use, social networks use). The instructions of the current questionnaire were individualized for the specific activity.

Table A.2
Descriptive values of ECS (Experience of Compensation Scale) including mean, standard deviation, range, skewness, and kurtosis for all items (including the original German translation) defined before the exploratory factor analysis (EFA).

Instructions:
The following statements refer to your experience during [the use of a specific online application] compared to other activities or when you are not using the Internet.
Please mark which of the answer options applies most to you. There are no right or wrong answers; the important thing is that you rate each statement as it applies most to you.
While using [a specific application] , I …
(Die folgenden Aussagen beziehen sich auf das Erleben während des [der Nutzung einer bestimmten Online-Anwendung] im Vergleich zu anderen Aktivitäten oder wenn Sie das Internet nicht nutzen.
Bitte kreuzen Sie an, welche Ausprägung der Antwortmöglichkeit am ehesten auf Sie zutrifft. Es gibt keine richtigen oder falschen Nennungen; wichtig ist, dass Sie die Aussagen jeweils so beurteilen, wie es für Sie selbst am ehesten zutrifft.
Während ich [eine bestimmte Online-Anwendung] nutze, …)

	M (SD)	*Range*	*Skewness*	*Kurtosis*
01 feel less excluded (fühle ich mich weniger ausgeschossen)	1.52 (1.19)	0–4	0.210	−0.989
02 feel less stressed (fühle ich mich weniger gestresst)	2.10 (1.14)	0–4	−0.174	−0.696
03 feel less constricted (fühle ich mich weniger eingeengt)	1.86 (1.18)	0–4	−0.076	−0.975
04 feel less worthless (fühle ich mich weniger wertlos)	1.19 (1.11)	0–4	0.436	−0.984
05 feel less weak (fühle ich mich weniger schwach)	1.23 (1.10)	0–4	0.361	−0.996
06 feel less worried (fühle ich mich weniger sorgenvoll)	1.84 (1.15)	0–4	−0.040	−0.873
07 feel less incompetent (fühle ich mich weniger inkompetent)	1.25 (1.12)	0–4	0.501	−0.572
08 feel less inferior to others (fühle ich mich anderen Menschen weniger unterlegen)	1.22 (1.08)	0–4	0.493	−0.616
09 feel less lonely/alone (fühle ich mich weniger einsam/allein)	1.63 (1.18)	0–4	0.076	−1.00
10 feel less need of help (fühle ich mich weniger hilfsbedürftig)	1.24 (1.14)	0–4	0.503	−0.766
11 feel less unsuccessful (fühle ich mich weniger erfolglos)	1.26 (1.11)	0–4	0.450	−0.870
12 feel less bored (fühle ich mich weniger gelangweilt)	2.40 (1.20)	0–4	−0.470	−0.529
13 feel less self-dependent (fühle ich mich weniger unselbstständig)	1.27 (1.15)	0–4	0.601	−0.468
14 feel less like a loser (fühle ich mich weniger als Versager)	1.04 (1.12)	0–4	0.825	−0.174
15 feel less inner emptiness (fühle ich mich weniger innere Leere)	1.47 (1.24)	0–4	0.276	−1.17
16 experience less conflicts (fühle ich mich weniger Konflikte)	1.32 (1.13)	0–4	0.361	−0.932
17 feel less determined by others (fühle ich mich weniger fremdbestimmt)	1.20 (1.17)	0–4	0.076	−0.509
18 feel less useless (fühle ich mich weniger nutzlos)	1.09 (1.09)	0–4	0.600	−0.671
19 feel less insecure (fühle ich mich weniger unsicher)	1.36 (1.19)	0–4	0.407	−0.894
20 feel less rejected (fühle ich mich weniger zurückgewiesen)	1.25 (1.18)	0–4	0.542	−0.724
21 feel less unimportant (fühle ich mich weniger unwichtig)	1.28 (1.13)	0–4	0.368	−0.903
22 feel less tense (fühle ich mich weniger angespannt)	1.77 (1.09)	0–4	−0.072	−0.688
23 feel less powerless (fühle ich mich weniger machtlos)	1.09 (1.03)	0–4	0.564	−0.712
24 feel less isolated (fühle ich mich weniger isoliert)	1.51 (1.25)	0–4	0.279	−0.971
25 feel less dependent on others (fühle ich mich weniger abhängig von anderen Menschen)	1.36 (1.15)	0–4	0.306	−0.944
26 feel less concerned (fühle ich mich weniger beunruhigt)	1.50 (1.14)	0–4	0.176	−0.913

Note. At the beginning of the survey, all participants chose their favorite online activity (gaming, gambling, buying-shopping, pornography use, social networks use). The instructions of the current questionnaire were individualized for the specific activity.

Appendix B. Description of the data aggregation

For the validation of the factor structure, a further study was conducted. Thereby, we aimed to investigate the factor structure of the EGS and ECS as well as the relationship with further addiction-related constructs (e.g., use expectancies, craving, symptom severity) in a homogeneous sample regarding the distribution of the first-choice application. However, since the distribution was not equal across different activities (see distribution in 4.4.1 Participants), we included the data of a further study. Thereby, the participants have been asked to choose their online activity, they would like to self-regulate. Again, the EGS and ECS were modified for the activity chosen. We have now added all additional participants who use gaming, gambling, and pornography into the actual dataset. However, since more individuals reported using social networks and buying-shopping, we proceeded as follows. In the 1st dataset, the distribution in response behavior for social-networks use and buying-shopping were analyzed descriptively, supplemented with the 2nd dataset, and a random sample was then drawn from the total sample, which had a similar sample size to the gaming sample, but did not differ from the 1st dataset from the previous descriptive characteristics. No other significant difference could be identified between the datasets either.

Appendix C. Comparisons between non-problematic, problematic, and pathological users

Table C.1
Descriptive values (*M, SD, Range*) and group comparisons for the EGS overall score and the ECS overall score of non-problematic, problematic, and pathological users.

	Non-problematic users ($n = 678$)		Problematic users ($n = 157$)		Pathological users ($n = 158$)		Group comparisons
EGS: Overall score	1.87 (0.75)	0–4	2.29 (0.59)	0.83–4	2.65 (0.70)	0.67–4	$F(993,2) = 86.78$, $p \leq .001$, $\eta_p^2 = 0.149$ [1]
ECS: Overall score	1.13 (0.95)	0–4	1.97 (0.77)	0–4	2.43 (0.93)	0–4	$F(993,2) = 155.90$, $p \leq .001$, $\eta_p^2 = 0.240$ [1]

Note. The groups were divided using the short Internet Addiction Test. Participants with a sum score > 30 were classified as problematic and with a sum score > 37 as pathological users (based on Pawlikowski et al., 2013).

[1] Post-hoc analyses indicate significant differences between all three groups.

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