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# Gender differences in gratifications from fitness app use and implications for health interventions

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## Abstract

Previous research has shown gender differences in the motivations to be physically active, in mobile phone gratifications, and social media usage, but so far these areas have not been studied together. Based on the uses and gratification approach and self-determination theory, we aimed to identify gender-specific gratifications and determinants of fitness app usage in combination with fitness-related Facebook groups. Results of an online survey ( $N = 171$ ) and of a mobile experience sampling method ( $N = 31$ ) revealed that the app Runtastic was primarily used for achieving goals and to improve enjoyment for physical activity, with men and older participants sharing results with others in Facebook groups more often than women and younger participants. Conclusions regarding gender-specific targeting strategies and user-centered design and content of mHealth features are presented.

## Keywords

fitness apps, gender-specific health communication, mHealth, physical activity, self-determination theory, uses and gratifications approach

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Using mobile phones for health reasons, that is, mHealth (Nacinovich, 2011), has grown rapidly (PwC, 2012). About 19% of smartphone users in the United States and about 21% in Germany have installed at least one health app to track or manage their health (Forsa, 2013; Fox & Duggan, 2012). There is abundant evidence of the positive health outcomes of mHealth interventions in helping patients to reach their health and fitness goals (Chib, 2013; Higgins, 2016). Mobile technologies offer novel, cost-effective opportunities to target users in a way that is both interactive and individualized (Kreps & Neuhauser, 2010). But in order to ensure lasting adherence and effective usage of mHealth intervention tools and prevent high dropout rates, the tools need to be adjusted to the expected gratifications of the specific target group and integrated into the target group's existing communicational environment (e.g., their social media usage; Rabin & Bock, 2011).

The success of mHealth applications seems to be gender-specific. Game-based applications are more relevant for promoting physical activity among male adolescents (Arteaga, González, Kurniawan, & Benavides, 2012). Men's higher interest in and earlier acceptance of technology has resulted in higher mHealth adoption intentions as compared to women (Zhang, Guo, Lai, Guo, & Li, 2014). Gender differences have also been reported in mobile phone gratifications (Grellhesl & Punyanunt-Carter, 2012), social media usage (Kimbrough, Guadagno, Muscanell, & Dill, 2013), and motives for and engagement in physical activity (Lauderdale, Yli-Piipari, Irwin, & Layne, 2015). However, despite extensive research about mHealth in the context of physical activity (for a review see Middelweerd, Mollee, van der Wal, Brug, & Te Velde, 2014), few studies have considered the combination of media-related and health-related motives of behavior (Guo, Han, Zhang, Dang, & Chen, 2015). Our aim was therefore to understand how gender-specific motives for physical activity are related to the uses and gratifications of fitness apps. This understanding will then allow us to draw conclusions regarding tailoring strategies in mHealth and to gain insight into gender-specific content and functionality in health apps.

Self-determination theory (SDT; Ryan & Deci, 2000) offers an overarching theoretical background, as it has already been applied both for physical activity and for mobile communication. SDT posits that individuals' motivation is positively influenced by the fulfillment of three basic motivations: autonomy, relatedness, and competence. Positive feedback, freedom of choice, and social interaction improve adherence to physical activities by satisfying these needs (Ryan & Deci, 2000). Several features of mHealth applications such as self-monitoring, sharing results, voice coaches, and goal setting also address these motivations (Riley et al., 2011).

Health psychology research has specified several further motives that vary between different target groups. Men and women appear to exhibit very different motives for participation in physical activities (Molanorouzi, Khoo, & Morris, 2015), despite having similar processes of motivational regulation (Guérin, Bales, Sweet, & Fortier, 2012). Several studies have demonstrated that women are mostly motivated by appearance, weight management, and health, whereas strength, competition, and challenge were found to be more important for males (Azevedo et al., 2007; Egli, Bland, Melton, & Czech, 2011; Kilpatrick, Hebert, & Bartholomew, 2005; Molanorouzi et al., 2015). These differences of motives for physical activity serve as starting points to understand the gender-specific usage of mobile fitness apps.

For integrating motives for physical activity with communicative needs we employed the uses and gratifications approach (UGA) that analyzes what drives users to engage in the regular intentional or habitual usage of media (Blumler & Katz, 1974, p. 20). An interconnection between the UGA and SDT has already been provided by Ang, Talib, Tan, Tan, and Yaacob (2015), who linked attributes of online social networks and users' media gratifications to psychological need satisfaction. Although originally developed to understand radio and television usage, researchers have applied UGA to Internet and mobile media usage as well, including social networking sites (Smock, Ellison, Lampe, & Wohn, 2011), SMS text messaging (Grellhesl & Punyanunt-Carter, 2012), and apps (Lin, Fang, & Hsu, 2014). In addition to the user motives of information seeking and entertainment, social gratifications—that refer to the need for relatedness—were included in these typologies to explain mediated communication (Liu & Wei, 2014). Further gratifications of fitness apps can be deduced from the application of SDT to motivations for video games, where media enjoyment, competition, and achieving goals were conceptualized as need satisfaction of competence and autonomy (Ryan, Rigby, & Przybylski, 2006; Tamborini et al., 2011).

While usage rates by now are similar between men and women (“MobiLens,” 2016), the uses and gratifications of mobile phone usage are still different between them. Applications of the UGA to mobile phone communication found that entertainment and task-oriented activities (i.e., receiving information) were more important for men than for women, who mainly use mobile phones for social reasons, such as staying in contact with family or receiving support and feedback from others (Grellhesl & Punyanunt-Carter, 2012; Kimbrough et al., 2013). To date there has been no exploration as to if and how these differences are also relevant for the usage of fitness apps and related social network sites. Gaining a better understanding of gender differences in sought gratifications would help health communication scholars to develop gender-specific mHealth interventions.

Because studies assume gender-specific motives for physical activity, we assume that there also exist gender differences in gratifications as they pertain to fitness app usage. Therefore, our first hypothesis is as follows:

H1: Differences exist between men and women regarding the relevance of specific gratifications of fitness app usage.

Reflecting on the most common motives of men for physical activity, men might seek more opportunities for competitive comparison in physical activity apps than women. Therefore, we predict the following more specific hypothesis:

H2: Gratifications that are connected with a comparison of results are more relevant for men than for women.

Mobile devices can be used outdoors (i.e., there are part of the physical activity) and comprise tracking tools and social connection (Liu & Wei, 2014) that allow for the application of a variety of behavior change strategies. By offering real-time monitoring, mobile devices can provide immediate feedback to users on their performance, whether

they have reached their goals and other supportive messages. Receiving immediate feedback on behavior or achievement of behavior goals is an evidence-based, effective behavior change technique (Abraham & Michie, 2008) and supports self-determination (Ilies & Judge, 2005). Engagement can be further enhanced by competitive features, motivational messages, and rewards (Arteaga et al., 2012). Meta-analyses and systematic reviews of interventions to promote physical activity using health apps or text messages have reported that the majority of such studies have yielded statistically significant results for health outcomes (Fanning, Mullen, & McAuley, 2012; Payne, Lister, West, & Bernhardt, 2015; Stephens & Allen, 2013). Several mobile technologies have been identified as increasing motivation for and long-term engagement with physical activity. Among them are:

- Self-monitoring documentation; the collection and transmission of objective, real-time behavioral and biofeedback data (O'Reilly & Spruijt-Metz, 2013).
- Personalized, supportive messages via immediate feedback, affirmations, text messages, or direct communication with individuals (Middelweerd et al., 2014).
- Enjoyable features, such as games and social networking, information sharing in a social community, contests, status updates (Gotsis, Wang, Spruijt-Metz, Jordan-Marsh, & Valente, 2013).
- Adding social network features in order to provide the opportunity for sharing personal content (Loss, Lindacher, & Curbach, 2014).

The importance of such functions and features might vary with gender due to differences in the usage and gratifications of men and women and the different motives for physical activity. To date, few apps take into account the gender-specific aspects of theories of health behavior, or are targeted and tailored to users' specific needs (Rabin & Bock, 2011). Based on the gender differences in gratifications in general fitness app usage, we also assume that the usage and gratifications for specific functions of mHealth applications (e.g., voice coach or sharing results) are gender-specific and we propose the final hypothesis:

H3: Differences exist between men and women regarding the usage of specific mHealth functions.

To test these hypotheses, we employed a mixed-method design, with an online survey followed by a mobile experience sampling method (MESM) study. Memory mistakes and retrospective rationalization—two often-criticized aspects of studies based on UGA (Scherer & Schlütz, 2002)—are minimized in MESM, which directly measures motivations for app usage after engaging in the behavior.

## Study I

### *Participants and procedure*

In Study I an online questionnaire was conducted targeting fitness app users from August 20 to September 5, 2014. Participants for the online survey were recruited from several

German Facebook groups and online forums for running and other athletic activities; this was complemented with snowball sampling via Facebook. While the survey was completed by 247 participants, our analysis was based only on users of the fitness app Runtastic. This allowed us to compare the uses and gratifications of the same functions of a single app. The subsample of Runtastic users was 69% ( $n = 171$ ) of the overall sample, and was 50.9% men and 47.2% women (three respondents did not state their gender). The mean age of respondents was 38.4 years ( $SD = 10.6$ ), ranging from 17 to 66.

The app Runtastic was chosen because it is not only free, but can be downloaded from different app stores (e.g., iTunes, Google Play) and used with various operating systems (e.g., Blackberry and Windows). Runtastic is among the most popular physical activity apps in the health and fitness category (C.-H. Yang, Maher, & Conroy, 2015), with more than 80 million registered users worldwide (Runtastic, 2016). This popularity ensures that a sufficient number of participants can be recruited to test potential behavior-changing strategies. Indeed, within our sample of all fitness app users ( $N = 247$ ), other fitness apps, such as RunKeeper, Freeletics, MyFitnessPal, or NoomWalk were only used by a small number of participants, with fewer than 25 participants reporting using each of these tools. Runtastic can be used for a wide range of physical activities, including running, hiking, or cycling, and includes functions where results can be easily shared with others on social media platforms. This ease of social sharing means that strategies for seeking social support (including real-time peer social support), making comparisons with others or with one's former self, or requiring others' approval are all available.

## Measures

**App usage.** Fitness app usage was assessed with three separate questions: (a) "Do you use the app Runtastic?"; (b) "How long have you been using the app?"; and (c) "How often do you use the app?"

**Physical activity.** Participants' physical activity was measured using key indicators of physical activity frequency and duration (Krug et al., 2013). To calculate the total amount of physical activity per week, the number of days was multiplied by mean daily duration (Krug et al., 2013).

**Gratifications of app use.** Eight gratification items were adapted from studies analyzing the uses and gratifications of mobile and online media (Minge & Riedel, 2013; Smock et al., 2011; Wu, Wang, & Tsai, 2010). The items were reformulated to be applicable to fitness app usage where necessary. Respondents stated their degree of agreement on a 5-point Likert scale (from 1 = *strongly disagree* to 5 = *strongly agree*) with the following statements: "The app helps to motivate me to be more physically active" and "I enjoy using the app" (*enjoyment*:  $r = .47, p < .001$ ); "I can reach my goals with the app" and "The functions of the app are just right for my goals" (*goals*:  $r = .53, p < .001$ ); "I can compare my results with other users" and "I can compare my own previous and current results" (*comparison*:  $r = .37, p < .001$ ); and "The app makes me feel less lonely" and "I use the app because everybody else is doing it" (*companionship*:  $r = .33, p < .001$ ). The gratification items refer to the different intrinsic needs included in SDT, that is,

enjoyment, comparison and goals as forms of competence, and autonomy and companionship as a form of relatedness (Ryan et al., 2006; Tamborini et al., 2011).

**Facebook group usage.** Participants were also asked whether they participate in any Facebook groups organized around athletic activities such as running. If they answered yes, they were asked how often they share their personal activity tracking there, on a 5-point Likert-type scale from 1 = *never* to 5 = *always*.

## Results

About one third of our sample (32.9%;  $n = 56$ ) used the Runtastic app quite frequently, more than four times a week. Nearly half of the sample (48.8%;  $n = 83$ ) used the app one to four times a week. The remaining 18.2% ( $n = 31$ ) used Runtastic only once or twice a month. More than four fifths (85.8%) had used Runtastic for longer than 4 months, 2.9% had just started using the app within the last month, and 11.2% had used the app for between 2 and 4 months. Almost half of the participants (43.7%) reported being physically active 3 or 4 days a week and 38.0% reported being physically active 5 to 7 days a week. The majority (82.9%) got at least 2 hours a week of physical activity, and more than half of the participants (51.3%) exceeded 4 hours of activity. There were no gender differences in our sample concerning duration of app usage or the frequency or duration of physical activity.

Our results indicate that achieving goals and being more motivated by enjoyment are the most important gratifications predicting engagement in a physical activity app; companionship is much less important (see Table 1). In reference to H1, there was a significant difference between female and male participants, with both achieving goals and enjoying being more important for women than for men in our sample. There was no significant difference for comparison. The assumption of H2—that comparison is a more relevant gratification for men than for women—could therefore not be confirmed in Study 1.

A high percentage of the participants (84.7%,  $n = 144$ ) were members of Facebook groups related to athletics or Runtastic; however, this finding can be partly attributed to our snowball recruiting method. Almost two thirds of participants (64.6%;  $n = 93$ ) often, very often, or always shared the results of their physical activities. To analyze factors

**Table 1.** Study 1: Pairwise comparisons of app usage gratifications for women and men.

Variables	Total		Men		Women		$t(df)$
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Enjoyment	4.06	0.90	3.85	0.92	4.28	0.82	3.22 ** (164)
Goals	3.79	0.95	3.63	0.92	3.96	0.88	2.32* (163)
Comparison	3.74	0.93	3.64	1.02	3.86	0.82	1.59 (164)
Companionship	1.57	0.75	1.53	0.74	1.62	0.78	0.74 (160)

Note. *N*'s range varies due to occasional missing data.

\* $p < .05$ . \*\* $p < .01$ .

**Table 2.** Study 1: Predictors of the sharing results via Facebook groups.

Variables	Sharing results		
	$\beta$	$t$	$p$
Constant		-3.14	.002
Gender (0 = female)	0.16	2.03	.045
Age	0.46	6.18	< .001
Exercise	0.12	1.66	.102
Enjoyment	0.18	1.68	.095
Goals	0.02	0.14	.890
Comparison	0.17	1.97	.052
Companionship	0.13	1.62	.102
$R^2$	0.33		
$F$	8.72**		

Note.  $N = 130$ , only those who are members of Facebook groups.

\* $p < .05$ . \*\* $p < .01$ .

influencing sharing, a linear regression was conducted with age, gender, level of physical activity, and gratifications entered into the model. Age ( $\beta = .46$ ,  $t = 6.18$ ,  $p < .001$ ) and gender ( $\beta = .16$ ,  $t = 2.03$ ,  $p < .05$ ) were both related to sharing the results of physical activity via Facebook groups ( $R^2 = .33$ ,  $F = 8.72$ ,  $p < .001$ ). Male participants and older respondents shared results via Facebook groups significantly more often than female and younger participants. Gratifications were not significantly related to sharing results (see Table 2).

## Study 2

### Participants and procedure

Fitness apps are used in particular situations, that is, during exercise, like running or cycling. A single online survey may therefore overlook situational circumstances influencing media usage; this is an often-criticized problem of global reports in UGA studies (Scherer & Schlütz, 2002). The mobile experience sampling method (MESM; Karnowski, 2013) addresses the difficulty of retrospectively recalling particular media use episodes in terms of frequency and motivations. In contrast to single-time questionnaires, experience sampling methods are based on self-reports of one's immediate situation. This reduces bias in retrospective recall, autobiographical memory, and the use of heuristics in response patterns (Scollon, Prieto, & Diener, 2003).

Our explorative MESM study was conducted using a sample of 31 users of the fitness app Runtastic. Participants were recruited from our online survey. Over a period of 2 weeks from September 6 to September 20, 2014, each participant received six text messages at random times to ensure ongoing participation. Participants were asked to fill out the questionnaire on their mobile phone every time they used the fitness app Runtastic. Each text message contained a reminder to participate in the study and a link to a short smartphone-optimized



questionnaire accessible via mobile Internet connection. Our total sample consisted of 143 usage occasions ( $M = 4.6$  per person;  $SD = 2.6$ ) reported by 31 German Runtastic users ( $n = 18$  women;  $n = 13$  men). Average age was 44, ranging from 26 to 66. Participants used the app Runtastic mainly for running (72.5% of all occasions).

## Measures

**Physical activity.** Participants' physical activity was measured by asking about the nature and duration of their physical activity.

**Gratifications of app use.** The same items as in Study 1 were employed for motivation ( $r = .51, p < .001$ ), goals ( $r = .45, p < .001$ ), and comparison ( $r = .19, p < .05$ ). The items for companionship were reformulated due to the low agreement level in Study 1, and were instead based on the social motives of the Motives for Physical Activity Measure (Ryan, Frederick, Lepe, Rubio, & Sheldon, 1997). These items were: "I feel connected to the other users" and "I feel motivated by the other athletes using the app" ( $r = .77, p < .001$ ).

**Functions.** The participants reported which functions of the app they had used. In addition to sharing results through social networks, voice coaching and live tracking—as features offering social support—were provided in a list of possible responses. The coach function provides audio feedback in response to the achievement of set goals. The live tracking feature allows others in the network to exactly see where the athlete is on the map, how far he or she has gone, and to provide real-time support ("15 Runtastic Features," 2016).

To examine gender-related differences in usage motivations and determinants of using certain functions or features of the app we employed multilevel logistic analyses using HLM 7 (Raudenbush, Bryk, & Congdon, 2010). The dependent variables showed a high interclass correlation coefficient when examined within subjects (sharing results,  $ICC = .82$ ; live tracking,  $ICC = .78$ ; coach,  $ICC = .77$ ), prompting the use of multilevel analysis. All variables were grand mean centered.

## Results

To analyze the associations between gender, gratifications, and functions of the fitness app (H3), we first conducted a frequency analysis to determine the most relevant functions. The three features of the app that were used most often to engage social support were sharing results, voice coach, and live tracking. While documentation was nearly always used by both male and female users, it seems that results were shared more frequently by men than by women (see Table 3).

To analyze the significance of gender differences in how frequently specific features were used, we conducted multilevel logistic models. To predict sharing via Facebook, live tracking, and the use of the voice coach, the influence of gender as a lone Level 2 predictor was entered in the first model. In a second model, we entered the four gratifications as Level 1 predictors (see Table 4).

**Table 3.** Study 2: Frequency of usage of Runtastic features in single occasions.

Variables	Total occasions		Usage occasions (men)		Usage occasions (women)		$\beta$
	N	%	N	%	N	%	
Documentation	132	92.3	66	100	66	85.7	
Sharing results	105	73.4	59	89.4	46	59.7	2.00*
Voice coach	68	47.6	37	56.1	31	40.3	2.30*
Live tracking	59	41.3	39	59.1	20	26.0	1.42

Note.  $N = 143$  occasions from 161 male ( $n = 13$ ) and female users ( $n = 18$ ).  $\beta =$  Standardized regression coefficients for gender on Level 2 of a multilevel model as a single predictor.

\* $p < .05$ . \*\* $p < .01$ .

**Table 4.** Study 2: Predictors of fitness app functions.

Parameter	Sharing results	Live tracking	Voice coach
	$\beta$	$\beta$	$\beta$
Intercept	1.31**	-0.81*	-0.36
Level 1			
Enjoyment	0.12	0.14	0.98
Goals	-0.85	-0.84	0.53
Comparison	1.08	1.03*	0.45
Companionship	0.12	1.17**	0.90*
Level 2			
Gender (0 = female)	0.97	1.37	1.05
Age	0.11*	-0.05	-0.02

Note. Standardized regression coefficients from the two levels, including predictors at the level of occasions ( $n = 143$ ) and user level ( $n = 31$ ).

\* $p < .05$ . \*\* $p < .01$ .

When entered as a single predictor in the models, gender was a relevant determinant in whether participants shared results ( $\beta = 2.00, p < 0.05$ ) or used the live tracking feature ( $\beta = 2.30, p < 0.01$ ). However, gender ceased to be relevant when age and situational gratifications were entered into the models. In this new model, age ( $\beta = .11, p < 0.01$ ) was the sole predictor of whether one shared results via Facebook groups, and the search for companionship was positively associated with using both live tracking ( $\beta = .11, p < 0.01$ ) and the voice coach ( $\beta = .11, p < 0.01$ ), but not with sharing results on Facebook. In predicting the use of live tracking, competition was also a relevant gratification. The assumption of H3—that gender differences exist for functions usage—could therefore only be confirmed for usage of the functions for sharing results and tracking, which are related to the gratifications of companionship and comparison.

## Discussion

Both studies extend past research exploring the relationship between expected gratifications and fitness app use by focusing on gender differences. Both in the online survey and in the MESM, enjoyment and achieving goals were the most important gratifications met by using the app. To combine such apps with social media seems to further enhance this effect by fulfilling social gratifications. Sharing the results of physical activities via Facebook can provide social support through friends' encouraging comments or their own status information, allowing the comparison of one's own results with others'.

Despite comparable levels of physical activity and app usage, the gratifications associated with app use seemed to be gender-specific. When using mobile media for physical activities, women found enjoyment and goal-setting more important than did men. This might reflect higher motivation of women for health-oriented behavior (Courtenay, 2003). Men were more inclined to share their results and to use the live tracking function. However, gender-specific motives for participation in physical activities—such as competition and challenge for men (Molanorouzi et al., 2015)—seem to be less relevant for using specific features of fitness apps. When looking at the gratifications in specific situations (as represented by specific instances in the MESM), companionship seems to be the most relevant facilitator for the usage of social features, which were used more frequently by men.

These results might have also been influenced by individuals' gender-role orientation (Clément-Guillotin, Chalabaev, & Fontayne, 2012). It might be the case that the highly active women (as the ones we recruited in our studies) might have scored high on masculinity and therefore were similar to men concerning their needs for competitiveness. This might also apply for the relationship between gender and mHealth gratifications in other cultures. Although the motivational processes of SDT are assumed to be universal across cultures (Ryan & Deci, 2000), gender-role orientations arising from differing social and cultural environments might differentially influence sport motivation and participation for men and women (Chalabaev, Sarrazin, Fontayne, Boiché, & Clément-Guillotin, 2013). Further research should therefore include measures of gender orientation such as the Bem Sex-Role Inventory (Bem, 1981) and samples more diverse in physical activity and cultural background.

Age also appeared to be relevant to the use of social media in the context of fitness apps. Although physical activity (Krug et al., 2013), smartphone usage (Bitkom, 2016), adoption of mobile technologies (Chan, 2015), and health-related social media use (Baumann & Czerwinski, 2015) have generally been negatively correlated with age, in our sample, age was positively correlated with sharing results in the fitness app Runtastic. This inconsistent finding should be examined in further research. It might be the case that both forms of social gratifications (companionship and comparison) can independently influence health-relevant behavior (Okun et al., 2003). While adults older than 30 years state companionship as an important reason to exercise (Rossmann, 2013), adolescents and younger adults tend to be more oriented towards their peers' evaluation (Priebe & Spink, 2011). Accordingly, future studies should investigate whether the perception of usefulness of sharing results, which has been shown as critical motivator for mobile adoption in older age cohorts (K. Yang & Jolly, 2008), is higher for older users.

Our results also have theoretical implications. For example, mHealth research might benefit from integrating health psychology results into models of media usage. Here, SDT provides relevant motives for media gratifications. Especially in the case of the UGA—which has often been criticized for lacking a theoretical basis (Ang et al., 2015)—integrating health psychology results might represent a key extension. Rather than only using SDT as a basis for gratifications (as we did), future studies of mHealth applications could directly test the fulfillment of competence, autonomy, and relatedness needs by using SDT scales such as the Player Experience of Need Satisfaction (Ryan et al., 2006).

There were three notable limitations to the present studies. First, the generalizability of findings is limited due to selection bias in participant recruitment; as samples were drawn from Facebook groups for physical activities and existing users of the Runtastic app, the results of these studies may not be generalizable to the entire population. The level of physical activity in our sample was also higher than average. In Germany, 80% of the population reportedly do not reach the minimum of 150 minutes per week (Krug et al., 2013) recommended by the World Health Organization (WHO, 2016); in our sample, fewer than a quarter (23.2%) of our respondents did not reach this level. Therefore, results cannot be generalized to more sedentary individuals. Future research, for example, when testing exercise interventions, should differentiate between individuals in different stages of exercise behavior change and at different activity levels, because they tend to endorse dissimilar mechanisms of SDT motivational regulation (i.e., internal or external; Fortier et al., 2012). This may mean that the motivation for physical activity provided by fitness apps might have been overestimated, and that real motivation is lower than what was found in the present studies. Our use of a convenience sample might also underestimate the importance of other gratifications, for example, game-based applications might be more relevant for promoting physical activity in less active men (Arteaga et al., 2012).

The second limitation was that the use of self-report measures to gather mobile communication and physical activity, which may have allowed respondents to give socially desirable responses, inflating their physical activity scores or biasing them in their reporting of their mobile phone use and gratifications. Vanden Abeele, Beullens, and Roe (2013) have reported differences between behavioral and self-reported mobile phone use. Using data obtained by the network or app provider, or using behavioral physical activity data might improve the validity of the measurement. Furthermore, the gratification of competition might have been one that seemed less desirable to report than companionship or enjoyment.

The third limitation concerns the measurement of the gratification variables with two items. In order to have comparable items in Study 1 and Study 2 we decided for the shorter version and against scales with more items, which might have provided better internal consistency of the gratifications.

Findings from our studies have identified three areas that have implications for health education. Although our findings indicate that mobile applications might be an effective strategy for promoting physical activity in both men and women, they give some support to the conclusion that such interventions should be gender-specific. To date, most mHealth intervention programs have been directed at general populations; recipient gender is not usually taken into account, despite the fact that gender-specific health communication has long been called for and can be quite successful (Altgeld & Kolip, 2006). Differences in gratifications and related functions might provide a basis for gender-specific strategies to

promote physical activity, especially to reach and encourage target groups that could not be reached via other programs due to barriers like location or lack of time (Reifegerste, 2014).

The second implication is that these findings provide a basis for determining what features of mHealth interventions should be used. Mobile applications to promote physical activity should include features that allow users to document their activities and elicit social support in the form of encouraging (i.e., live tracking) or supportive messages (i.e., voice coach). Here, behavioral change techniques such as goal-setting or social support—which are already known from interpersonal health interventions (Abraham & Michie, 2008), and which have already been successfully applied to online interventions (Webb, Joseph, Yardley, & Michie, 2010)—might help to inform the best features to use for mHealth interventions.

The third implication implied by our results is that gratification research is an important prerequisite to developing mHealth interventions that are both theoretically based and user-centered (Bert, Giacometti, Gualano, & Siliquini, 2014). This kind of initial analysis might also reveal, for example, that apps are less effective as stand-alone interventions, but instead need to be combined with social media or other forms of health promotion (e.g., running groups) to fulfill user gratifications and sustainably engage target groups in physical activity (Stephens & Allen, 2013). Future research should therefore test interventions that either compare or combine fitness app usage with other measures.

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