Investigation of UX and Flow Experience in Sports Activities during the Covid-19 Pandemic: A Comparative Analysis of Cycling Apps

Klemens Weigl[1,2,3][a], Sabrina Schuster[1][b] and Andreas Riener[1][c]
[1]*Human-Computer Interaction Group, Technische Hochschule Ingolstadt (THI), Esplanade 10, 85049 Ingolstadt, Germany*
[2]*Department of Psychology, Catholic University Eichstätt-Ingolstadt, Germany*
[3]*Department of Psychology, DHGS German University of Health and Sport, Berlin, Germany*

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Abstract: Since the onset of the Covid-19 pandemic, a dramatic increase in mHealth application (app) downloads has been documented. However, overall dwell retention for fitness apps is low, so gamification techniques are used within apps with the goal of positively influencing the user experience and ultimately the user's motivation. The so-called flow, which is related to intrinsic motivation, has been little explored in the context of cycling apps. Therefore, we conducted a quasi-experimental cycling study with 34 cyclists (20 female, 14 male; 19 to 57 years old) who tested the adidas Running by Runtastic (Adidas Runtastic), Komoot, and Strava cycling apps during a 20-minute bike ride. After testing each cycling app, they completed the User Experience Questionnaire (UEQ) and the Flow State Scale-2 Short (FSS-2S). Our results showed no significant differences across the six factors of the UEQ, nor across the total score of the FSS-2S. Thus, we conclude that the three cycling apps Adidas Runtastic, Komoot, and Strava are perceived and rated almost equally by female and male cyclists.

1 INTRODUCTION

Smartphone applications (Apps) are ubiquitous nowadays. In 2020, the four main App stores offered more than 6 million applications for their respective users (Appfigures, & VentureBeat, 2021). Since the first quarter of 2020, marking the beginning of the Covid-19 pandemic, the number of health and fitness App downloads worldwide increased from 419 million downloads in the fourth quarter of 2019 to 656 million downloads in the second quarter of 2020, which translates into an increase of 237 million downloads (+56,56%) within just nine months (Sensor Tower, 2020). With nationwide lockdowns and closed gyms, people tried to stay fit with Mobile Health (mHealth) (Olla and Shimskey, 2015) Apps.

However, what can often be seen is a decrease in interest over time known as *hype cycle* (Ferrara, 2012). After a few days or weeks the initial excitement slowly drops and nearly one out of four Apps will only be used once after the download (Business 2 Community, 2019). This is a critical scenario as users will either abandon an App or continue using it. Hence, more and more applications include gamification (Deterding et al., 2011) to influence the user experience (UX) and captivate users encouraging them for a long-term use of an App. Based on several studies in recent years, paradigms (Deterding et al., 2011), categorizations (Lister et al., 2014), frameworks (Vaghefi and Tulu, 2019; Chou, 2019) and lists of the most important game elements (Dallinga et al., 2018) were established. The true effectiveness of gamification has not yet been fully explored, however, it appears that the use of gamification has an impact on users both short-term and long-term motivation (Hamari and Koivisto, 2013; Link et al., 2014; Barratt, 2017; Hamari, 2017; Hassan et al., 2019; Vaghefi and Tulu, 2019; Schmidt-Kraepelin et al., 2020) with differences in the perception within the population (Link et al., 2014). Thereby, the probability of creating a long-term engagement is enhanced while simultaneously the retention rate is intensified if users are periodically introduced to new game elements within the App over time (Link et al., 2014). Rarely if ever taken into account in the matter of gamification is the phenomenon *flow* (Csikszentmihalyi, 2014). The

[a] https://orcid.org/0000-0003-2674-1061
[b] https://orcid.org/0000-0003-2396-1907
[c] https://orcid.org/0000-0002-9174-8895

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term is often used in everyday language to describe an enjoyable moment or experience which is deeply involving for the respective person. Flow is not cultural nor situation bound, but can be experienced during any activity - most commonly creative and physical activities - while simultaneously often achieving peak performances (Csikszentmihalyi, 2014) which further motivate users and athletes and therefore increase retention rates for mHealth Apps.

However, to the best of our knowledge, there exists no study which explores the effects of gamification on flow experiences in cycling applications. By identifying the connections between the use of game elements in the cycling applications *adidas Running App by Runtastic* (hereinafter referred to as Adidas Runtastic), *Komoot*, and *Strava* and flow experiences, mHealth applications can retain their users more long-term oriented, which has advantages for both sides: users improving their health and health behavior and creators increasing their business.

1.1 The Present Study

Consequently, we carried out a quasi-experimental outdoor cycling and questionnaire study and investigated the following research questions (**RQs**) and hypotheses (**Hs**).

RQ1 (User Experience): How is the influence of different gamified menus on the user experience of the cycling Apps Adidas Runtastic, Komoot, and Strava?

- **H_1:** Although Strava is especially developed for and used in the cycling community, we suppose that the user experience of Adidas Runtastic and Komoot is perceived and rated roughly the same as Strava (Note: the three Apps can also be used in other sports activities, for example, in running).

RQ2 (Flow Experience): How is the influence of gamified menus on the flow experience when using the Apps Adidas Runtastic, Komoot, and Strava?

- **H_2:** We expect that different gamified menus of the Apps Adidas Runtastic, Komoot, and Strava do not affect the flow experience (which is related to intrinsic motivation).

2 METHOD

2.1 Participants

In total, 34 subjects participated in the study with 20 women aged 19 to 57 (M = 32.50, SD = 13.27) and 14 men aged 19 to 56 (M = 39.50, SD = 13.31). Fourteen participants were married, another 14 were singles, and 6 were in a relationship. At the level of education, 17 people had completed vocational-occupational training (apprenticeship) or vocational-school training, and 16 participants had a university degree (one person did not specify). Furthermore, 14 of the participants stated that they were living in a city, 10 near a city, 8 in a small rural village, and 2 said they live in the countryside. A driver's licence was held by 32 participants with a validity period from one to 40 years. While public transport is regularly used in leisure time by 11 subjects, all 34 stated that they were using a bike for transport as well. Hereby, 2 participants reported that they ride their bike ten times per week, 1 seven times, 3 six times, 8 five times a week, another 8 four times, 6 three times, 2 twice, and 3 once per week. The participants were further asked if they regularly go running (12/34) or nordic walking (6/32). Fourteen people stated that they had cycled as a hobby sport for at least one year and 7 had also participated in competitions. Finally, 18 participants reported to know at least one of the three Apps with Komoot being the best known (14), followed by Adidas Runtastic (9), and Strava (8) and among them, 12 used them regularly and will continue to do so in the future. The majority of participants had a German citizenship (33). All participants were fluent in German and consumed no alcohol or drugs. Participants were recruited via e-mail, telephone, messages or personally based on the following inclusion criteria: (1) can ride a bike, (2) ride a bike regularly, (3) are physically active, (4) are healthy (i.e., were not chronically ill or physically impaired in the conduct of the study), (5) own a smartphone, and (6) are willing to download the Apps Adidas Runtastic, Komoot, and Strava and test them during a bike ride.

2.2 Design and Materials

We conducted a cross-sectional quasi-experimental outdoor cycling study and adopted a one factorial (3 x 1) within-subjects design with the three Apps Adidas Runtastic, Komoot, and Strava as three conditions and within-subjects factor. The three Apps were provided in a counter-balanced way to all participants. Our dependent variables were the six factors of the User Experience Questionnaire and the total score of the Flow State Scale-2 Short, all directly provided after testing each of the three Apps, respectively. Additionally, we asked the participants to rank those three Apps.

2.3 Questionnaires

In this section, we explain the two self-rating scales, which we deployed on LimeSurvey, Version 3.12.1+180616, (Team and Schmitz, 2021). We collected the data online directly after testing each App, so the perception and assessment were still accurate. Because of the counterbalanced allocation of each participant to the three Apps, every subject was assigned a pseudonym which had to be entered at the beginning when answering the online questionnaires. Later the pseudonym was used for the connection of the three data sets and deleted afterwards. Hence, after the deletion of the pseudonym the data set was anonymously.

2.3.1 User Experience Questionnaire (UEQ)

The User Experience Questionnaire (UEQ) was developed by (Laugwitz et al., 2008). To study RQ1 (cf. section 1.1), we applied the long version to compare the user experience between the three Apps Adidas Runtastic, Komoot, and Strava. The UEQ contains 26 items on a 7-point rating scale ranging from -3 to +3 and each item is denoted by two words with polar opposing meanings. Typical items are verbally anchored with, for example, ”annoying” vs. ”enjoyable” or ”pleasant” vs. ”unpleasant”. The UEQ covers the following six subscales: (1) attractiveness (6 items; Cronbach’s α = .91, .86, .90 for the Apps Adidas Runtastic, Komoot, and Strava, respectively; also in the following parentheses), (2) perspicuity (4 items; Cronbach’s α = .83, .77, .82), (3) efficiency (4 items; Cronbach’s α = .79, .61, .69), (4) dependability (4 items; Cronbach’s α = .67, .80, .43), (5) stimulation (4 items; Cronbach’s α = .90, .86, .79), and (6) novelty (4 items; Cronbach’s α = .78, .84, .87). As stated in the parentheses, we computed Cronbach’s α which is considered as a measure for internal consistency, whereas values greater than .7 are classified as acceptable (Nunnally, 1978). Note that Cronbach’s α is sensitive to the sample size and the number of items such that a larger sample size and more items usually yield to a higher value (Taber, 2018). Hence, most values in this study can be considered as acceptable or at least as okay, given the rather small sample size and mostly only 4 items per subscale. Additionally, to perform consecutive statistical analyses, we also kept the factor dependability for the App Strava for practical reasons although Cronbach’s α was only .43. However, the factors (2), (3), and (4) are attributed to pragmatic quality, and the factors (5) and (6) to the hedonic quality.

2.3.2 Flow State Scale-2 Short (FSS-2S)

To measure a potential flow experience (Csikszentmihalyi, 2014) and address research questions RQ2 (cf. section 1.1), the Flow State Scale-2 Short (FSS-2S) was used with one question per factor as proposed by (Jackson et al., 2008). The response format of the items was a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The factors (which correspond with the nine flow dimensions) are as follows: (1) challenge-skill balance, (2) action awareness merging, (3) clear goals, (4) unambiguous feedback, (5) concentration on task at hand, (6) paradox of control, (7) loss of self-consciousness, (8) transformation of time, and (9) autotelic experience. Example items are for (1) ”I feel I am competent enough to meet the high demands of the situation” or (2) ”I do things spontaneously and automatically without having to think”. As suggested by the original authors, we computed the total score (i.e., the sum score) across all nine items and used this factor for each App for further analyses. Note that based on the 9 different dimensions each measuring a different aspect of flow, in this case, Cronbach’s α can be omitted. In contrast, Cronbach’s α was reasonable for the UEQ, whereas each different factor is considered separately with several items loading on the respective factor.

2.4 Apps

The Apps Adidas Runtastic (runtastic GmbH, 2021), Komoot (komoot GmbH, 2021), and Strava (Strava Inc., 2021) are available for download in the major App stores like the Google Play Store or Apple’s App Store and were used in the freemium version. As mentioned in the beginning, mHealth applications have seen an increase in user numbers since the beginning of the Covid-19 pandemic, hence the three popular cycling applications were chosen for this study.

Adidas Runtastic is a fitness App focusing on running and fitness in general. Adidas acquired the app *Runtastic* and the eponymous existing company in August of 2015 and re-branded them in August 2019 (Widmann, 2015). With more than 177 million registered users and more than 330 million downloads (Runtastic, 2021), Adidas Runtastic is one of the most popular mHealth applications in the fitness category (Airnow, 2021).

Komoot is an outdoor App, which advertises mainly with its *smart route planner*, *turn-by-turn voice navigation*, *tips from other users* and *inspirational content* (Komoot, 2021) which can be used during different types of sport. The figureheads are

cycling and hiking. Komoot, launched in 2010 by Markus Hellermann (Schnor, 2018), has more than 18 million active users worldwide (Komoot, 2021) and is one of the most popular mHealth applications in the fitness category, too (Airnow, 2021).

As described, Adidas Runtastic and Komoot are two very popular mHealth Apps. The best known application in this segment for cycling, however, is **Strava** with 21.5 million uploads every week by 74 million users resulting in four billion activities (Strava, 2021a) since its launch in 2009. It was founded by Mark Gainey and Michael Horvath (Bailey, 2018). Like Adidas Runtastic and Komoot, Strava offers users to track different activities and monitor one's progress based on comprehensive data. Strava describes itself as *the social network for athletes* (Strava, 2021b), hence, all users are called *athletes* despite obvious differences between each user regarding physical shape, demographic factors and so on.

2.4.1 Common Features

The most obvious commonality of the three Apps Adidas Runtastic, Komoot, and Strava is the tracking of different sports activities. The tracked data can be analyzed in different display formats and be shared with friends or one's community. In all of them, the corporate identity (CI) is easily recognizable through a uniform appearance. This is expressed, among other things, through colors, icons, texts, and formulations. The Apps are also similar in the gamification area since all use certain elements, which will be discussed in detail later. Regarding information architecture (IA) and navigation, all three applications use a bottom navigation bar with five items as a main navigation including a page for tracking an activity, a profile site, as well as a feed or discover page. The IA is the framework of an application structuring the underlying organization. It can not be seen by the user through the front-end UI design but has an influence on the UX. The IA's tasks include identifying and defining content and functionality as well as the correlation between both (Cardello, 2014). A search function is available in every application as well and it functions as search feature for friends and other people one wants to follow. Adidas Runtastic, Komoot, and Strava all have extensive settings where users can customize their experience. A community section is present in all of them, too, albeit in different forms which will be further described below.

2.4.2 Differences

Even though there are some similarities between Adidas Runtastic, Komoot, and Strava, there are also major differences. First, the number of available sports: Komoot offers its users 21, Strava 31, and Adidas Runtastic 94 different types of sports. Here, Adidas Runtastic has potentially the largest target group. However, the three focus not on all available sports as special emphasis is placed on some sports: Strava focuses mainly on cycling, running and swimming; Komoot uses cycling, running, hiking, and walking as figureheads; and Adidas Runtastic is mainly aimed at runners and cyclists. In addition to the different focuses on the target groups and sports, there are also differences in the overall orientation of the Apps. Strava and Adidas Runtastic focus their attention on tracking activities and analyzing the respective data, whereas Komoot rather advertises the navigation feature as well as route creation. The former however, is solely available with Komoot as Strava and Adidas Runtastic do not offer a navigation feature. The similarities of Strava and Adidas Runtastic and simultaneous differences with Komoot go even further: both offer audio cues respectively a *Voice Coach* to inform users during an activity about their performance and data. Additionally, one can take place in challenges and events hosted by the Apps or third party providers. Such features are not available for Komoot users. A very popular feature of Strava are segments where users can compete against each other and earn trophies. The ten fastest athletes are displayed on a leaderboard and the leader receives the KoM (King of the Mountain) respectively QoM (Queen of the Mountain) for their performance (for an in depth explanation see (Barratt, 2017)). Another difference between Strava, Komoot, and Adidas Runtastic are goals. Users can set themselves clear goals in the freemium version solely with Adidas Runtastic; Strava offers this feature only in the paid subscription version. Lastly, Strava and Komoot users can like (give Kudos in Strava) and comment on posts by other users and engage with each other.

2.5 Procedure

Prior to the beginning of the main phase of the study, a pilot study with five participants was conducted. Based on those findings, the procedure of the user study was slightly optimized. Therefore, those data have not been included in the evaluation of the main study.

Before the beginning of the main phase, each participant received an introduction to the background of the study and was invited to ask questions throughout the entire study duration. Then everyone who wanted to participate provided written informed consent. After this introductory part, all participants filled the ques-

tionnaire items of the demographic variables such as age, gender, regular outdoor cycling (yes or no), duration of the daily commute by car, public transport, bicycle, etc. (cf. section 2.1). Upon completion of the first questionnaire part, everyone received the contact details of the examiner, in case of any questions.
Next, potential participants who suited the inclusion criteria described in section 2.1, were contacted and received standardized invitations to the App testing phase of the user study. Then the three Apps Adidas Runtastic, Komoot, and Strava were downloaded and each one was tested during a 20-minute bike ride (in total one hour) with active tracking by each participant. After testing the App, the respective online questionnaire had to be filled in. Finally, all participants had to take a screenshot of each bike ride on the App showing the recorded route with duration and send it to the examiner. This served as an assurance that the Apps were tested and the results were not falsified. As soon as the questionnaires were completely filled in and the screenshots were sent, each participant received a final "Thank You"-message.
The examiner was either present (especially for older people) or could be reached by phone, email, or video-call during the entire study duration which ranged from 80 to 90 minutes. Because of the pandemic situation during the conduct of the study, it was not tied to a specific location. Hence, each participant could participate at any location within a two-week time window for execution. Furthermore, the study was conducted on a voluntary basis and without financial compensation for the participants. However, all of them were invited to provide their email addresses if they were interested in the main results of the study.

2.6 Supplementary Materials

We support the open science movement and supply the data set (.sav and .csv) on OSF: https://osf.io/bx2js/ .

2.7 Statistical Analyses

At first, we performed data management and inspected the data set for completeness and duplicates, respectively, and removed incomplete or duplicate data entries. Then, we reverse-coded all negatively worded items and computed the respective mean scores for the UEQ and the overall sum score for the FSS-2S. Next, we set the significance level to $\alpha = .05$, and reported all results with $p < \alpha$ as statistically significant. At the beginning, we evaluated the statistical prerequisites and checked the factors of the UEQ and the FSS-2S for normality and variance homogeneity in all three App conditions, respectively. Normality was met for the FSS-2S and in 16 out of 18 cases for the 6 UEQ factors (x 3 Apps = 18). Because skewness and kurtosis as well as the QQ-plots indicated an acceptable distributional behavior of the data for the only two non-normally distributed factors, we conducted parametric statistical analyses and applied a repeated measures ANOVA to compare the three Apps with each other. We applied IBM® SPSS® Statistics, Version 25 (IBM Corp., 2017) for all statistical data analyses.

3 RESULTS

3.1 User Experience Questionnaire

For the UEQ exist norms (cf. the colored legend in Figure 1 with "Bad", "Below Average", "Above Average", "Good", "Excellent") generated from a data set with 18384 participants based on 401 studies (Schrepp et al., 2014). All three Apps have common results as all are "above average" for the subscales attractiveness, efficiency, and dependability (cf. Figure 1). For the subscales perspicuity and dependability Adidas Runtastic and Strava are likewise "above average", but Komoot is rated below average. The results of the subscale novelty reveal that Adidas Runtastic is rated "above average", but Komoot and Strava are classified "below average".

Besides this classification related to the norms, we applied repeated measures ANOVA on the mean scores separately for each of the six subscales of the UEQ to compare the three Apps. However, we identified no statistically significant difference between Adidas Runtastic, Komoot, and Strava in any of the six comparisons (cf. Table 1). Given those non-significant findings clearly indicating no substantial differences between the three Apps, of course, it did not yield any different results as we applied Bonferroni-Holm correction (Holm, 1979) to control for the alpha inflation because of multiple testing.

3.2 Flow State Scale-2 Short

We applied the repeated measures ANOVA on the three total scores of FSS-2S of the three Apps. However, we identified no statistically significant difference between Adidas Runtastic (M = 36.32, SD = 3.72, *min.* = 29, *max.* = 40), Komoot (M = 36.15, SD = 3.77, *min.* = 28, *max.* = 41), and Strava (M = 36.15, SD = 3.45, *min.* = 30, *max.* = 39), $F(2,66) = .04$, $p = .958$, $\eta_p^2 = .001$. We also supply the means and the

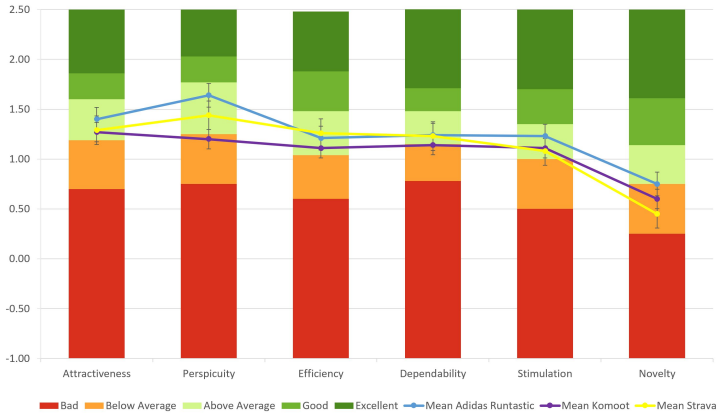

Figure 1: Means for the Apps Adidas Runtastic (blue), Komoot (green) and Strava (orange) of users in comparison with external user experience norms of UEQ (cf. colored legend below). The colored norms are generated from a data set with 18384 participants based on 401 studies (Schrepp et al., 2014).

Table 1: Descriptive Statistics of User Experience Questionnaire (UEQ).

	Adidas Runtastic		Komoot		Strava				
Factor	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F(df)*	*p*	η_p^2
Attractiveness	1.40	0.83	1.27	0.98	1.29	0.84	0.38 (2,66)	.683	.01
Perspicuity	1.64	1.00	1.20	1.25	1.44	1.03	2.48 (2,66)	.091	.07
Efficiency	1.21	0.89	1.11	0.59	1.26	0.73	0.38 (2,66)	.686	.01
Dependability	1.24	0.62	1.14	0.68	1.23	0.44	0.45 (2,66)	.643	.01
Stimulation	1.23	1.18	1.11	1.23	1.08	0.99	0.44 (2,66)	.644	.01
Novelty	0.75	0.92	0.60	1.28	0.45	1.65	1.43 (2,66)	.246	.04

standard deviations of the Apps across all nine dimensions in Table 2. Due to the very clear non-significant overall findings reported before (cf. also η_p^2), we do not report additional statistical tests at the level of the nine dimensions, which, however, would have resulted in nine non-significant findings as we have observed in supplementary analyses (beyond the scope of this results section). The reason why we supply Table 2 is to highlight that the Apps only marginally differed across those nine flow dimensions.

4 DISCUSSION

The purpose of this cycling App study was to investigate the user as well as the flow experience related to gamified menus during the use of the cycling applications Adidas Runtastic, Komoot, and Strava.

Our first objective was to investigate the influence of different gamified menus on the user experience of the cycling Apps Adidas Runtastic, Komoot, and Strava (**RQ1**). We found no differences between the ratings of the user experiences between the three Apps when applied in outdoor cycling. Although Strava was especially developed for and used in the cycling community, the Apps Adidas Runtastic and Komoot were perceived and rated almost equally. One reason for no substantial differences could be that all three Apps are developed and are constantly evaluated and updated by professional programmers, experts, users, and athletes at a very high level incorporating big data analyses. Therefore, we could accept hypothesis H_1.

Our second objective was to study the influence of different menus on the flow experience of the Apps Adidas Runtastic, Komoot, and Strava (**RQ2**). Our findings indicate that slightly different gamified menus and game elements applied do significantly affect the likelihood and the reporting of experienced flow. One reason could be that the Apps use different numbers of game elements (e.g., Strava and Adidas use similar numbers and both more than Komoot). Another, that the total score of the FSS-2S may not be sensitive enough to measure potential flow differences in contrast to the nine flow dimensions. However, if the nine flow dimensions would have been measured it would have been better to not apply the short form of the FSS with nine items, but the long form with 36 items. Besides this, flow is very dependent on the individual person and the nine flow components and may only be influenced to a limited extent by external factors such as gamified menus. Nevertheless, by incorporating various features like a *Voice Coach* in Adidas Runtastic to give unambiguous feedback to

Table 2: Descriptive Statistics of the Flow State Scale-2 Short (FSS-2S) for all nine Flow Dimensions for the Apps Adidas Runtastic, Komoot, and Strava.

	Adidas Runtastic		Komoot		Strava	
Flow Dimension	*M*	*SD*	*M*	*SD*	*M*	*SD*
Challenge-Skill Balance	4.54	0.82	4.29	1.07	4.47	0.81
Action-Awareness Merging	4.37	0.73	4.37	0.73	4.31	0.75
Clear Goals	4.29	0.75	4.43	0.66	4.31	0.67
Unambiguous Feedback	4.06	0.77	4.09	0.78	4.17	0.74
Concentration on Task at Hand	3.91	0.78	3.83	1.01	3.94	0.75
Paradox of Control	4.06	0.77	4.09	0.70	3.94	0.83
Loss of Self-Consciousness	4.17	1.01	3.94	1.31	4.08	1.13
Transformation of Time	3.03	1.20	3.37	1.00	3.00	1.31
Autotelic Experience	4.00	0.84	3.94	0.87	3.92	0.73

experience the transformation of time or the positive communities of each App to set optimized goals to influence the challenge-skill balance, they could make a small contribution to increase the probability of a flow experience. The impact of the described functions can not be confirmed entirely by the collected data as Adidas Runtastic and Strava incorporated most features related to flow components though results for the subscales are very similar for the three Apps. Hence, we could retain hypothesis H_2.

4.1 Limitations and Future Work

Although we observed no significant differences between those three Apps, this *null* result can be positively interpreted. It may be possible that there exists no substantial difference, what would imply that those three Apps offer roughly the same good features and menus. However, it has to be noted that the sample size of 34 subjects is rather small. Although the statistical power is usually greater for a within-subjects design, as in our case (compared to a between-subjects design), it would be interesting to re-conduct this study with a larger sample size. Finally, it can be assumed that the participants (most likely) did not experience flow but were closer to one than being away from it. In this regard, the study design could be slightly adjusted (what would require more organizational effort) and the Apps could be tested more often (e.g., 2 or 3 times) and for longer sessions (e.g., 30 minutes per session).

5 CONCLUSION

In this study, we evaluated the impact of gamification on user experience specifically for the cycling apps Adidas Runtastic, Komoot, and Strava, particularly regarding the aspect “flow”. To the best of our knowledge, this is the first cycling study that has focused on user and flow experience when using gamified menus in the context of cycling applications. Hence, our results provide an important link to begin to fill this research gap. In particular, it is noticeable that there are no significant differences between the Apps regarding user as well as flow experience, although they apply diverse game elements, incorporate distinct features, and are ranked differently by participants. Nevertheless, in future studies, it will be necessary to address these research questions again with a greater sample size and in relation with other personality traits. Thereby, it could be highly interesting to also focus on different levels of fitness of participants and long-term effects of gamification on flow experiences. However, we contribute to the growing trend of using gamified menus in Apps - especially mHealth Apps - to get the most benefit for all involved. In the following, we sum up the highlights of our study:

1. The user experience of gamified menus of the three cycling Apps Adidas Runtastic, Komoot, and Strava is perceived and rated almost equally indicating no significant difference.
2. The flow experience is not influenced by different gamified menus of the three cycling Apps Adidas Runtastic, Komoot, and Strava. Hence, it is perceived and reported almost equally highlighting no significant difference.
3. A slightly different number of applied game elements has most likely no effect on user and flow experience.

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