

The design of fitness apps

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As we live in busy times, people rarely find the time to sneak into the gym. Alternatively, very often they start doing exercises at home, in the office, in the hotel or other places. To be more flexible in organizing the day, more and more people nowadays use fitness applications or online services as substitutes for real personal trainers. An increasing number of apps is available in app stores. However, not all apps are designed to the benefits of their users. The better apps take into account that users need motivation and should develop a better life style gradually. We have analyzed existing apps and mined for best practices that are captured as design patterns. The patterns can help developers when they are creating new fitness apps. They can also be used to improve or evaluate existing services. End users can use the design patterns to understand whether an app provides the recommended features.

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1. INTRODUCTION

And suddenly you notice that you gained some weight, that your stamina eased off and that you ate unhealthy food. Sooner or later you realize that you have to change something. You start to eat healthier food or doing some workout to get fitter. The first few days it works well. You stick to your new rules. You may eat only specific foods or do some workout several times a week. This can cause that you feel great while doing this. This is until you see the first enticement, a piece of cake, which you want to eat while drinking coffee because of the fact that it is tastier than eating an apple. Somebody needs to support you. Somebody . . . or something.

Mobile devices have several distinct features that make them preferable for fitness applications. First, as they are mobile, users have access to them almost 24 hours, seven days a week. Hence, they can provide support and self-help at any time, at any place, whenever suitable. Second, the devices are used individually and can provide customized advice based on individual self-measurement and tracking of behavior. The device can be configured with user preferences and nudge users at appropriate moments. The interactivity of the device enables self-help to be customized not only to the individual but the changing situations of the individual: does the person have a 5-minute time slot or 60 minutes? Is the person in a relaxed mode or exhausted? What was the nutritional supply of the day? Third, mobile devices can connect to other devices and services. Hence, users can report

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their achievements to others, compete with others, pull information needed in specific situations (e.g. how many minutes do I have to spend on a cross-trainer to neutralize the calories of a chocolate bar). Fourth, high resolution screens of mobile devices enable engaging visualization and game-like moments to motivate users (gamification). Fifth, such devices are equipped (or can be extended) with several sensors that can automatically capture data about their users, for example daily steps (and other sport activities), heart rates, sleep times, photos etc.

All these factors provide opportunities to design apps that support a healthier life. Apps can be designed to support positive behavior changes. Wendel [2013] has described a methodology to design for behavior change, applying psychology and behavioral economics. While this framework provides insight to the human factors, it does not provide clear instruction how to achieve the behavior change in specific areas such as fitness programs. Patterns on the other hand can provide generalized design solutions for specific contexts. They can also integrate the ethical perspective and negative consequences. This is particularly important if you design applications that affect people's life and have impact on their decisions [Thaler et al. 2010]. Nudging people to take actions is desirable when people want to change. But putting social pressure on people to behave uniformly may have negative societal impact. Hence, healthcare apps in general need to balance individual freedom and choice as well as individual and community well-being.

The impact of healthcare apps on the individual life situation can be huge. If the app provides wrong or misleading guidance it can do serious harm to users. If the app is complicated, hard to use, bothering or just boring, it will soon be ignored and has no impact at all. Hence, apps should encourage users and accompany them on their path to success. Success needs to be defined for each individual user and apps should account for the diversity of goals and capabilities of users. Designing health apps is a very responsible task. The five patterns presented in this paper should trigger thoughts and reason about good solutions, providing justification for specific app features.

JOB DEFINED PROFILE is a way to simplify user settings based on job specific values. It maps abstract profiles about activity levels and suitable nutrition to specific profiles based on typical jobs.

EASY START accounts for the individual capabilities and limitations of users, right at the beginning. It supports users to get sense of doing workouts, avoiding over or under performance.

INCREASE INDIVIDUAL CHALLENGES ensure that users will be challenged at the right level continuously, ensuring that exercises match individual levels of skills, energy and time frames.

DO IT RIGHT INSTRUCTION emphasizes that exercises need to be performed correctly to have positive effects and avoid physical harm.

CALL FOR ACTION is a way to remind users recurrently to move on and motivate them over longer periods of time.

These patterns do not build a complete language yet. There are several more patterns we have identified and that will be described in future work.

2. MINING OF FITNESS APP PATTERNS

There are many ways to find interesting new patterns. We can draw from our own experience, ask colleagues and experts, or investigate existing systems [DeLano 1998].

The mining of patterns is an attempt to find the regularities and generative rules of design forms: "In all these cases, no matter what method is used, the pattern is an attempt to discover some invariant features, which distinguishes

good places from bad places with respect to some particular system of forces. [...] It is in the invariant behind the huge variety of forms which solve the problem. There are millions of particular solutions to any given problem; but it may be possible to find some one property which will be common to all these solutions. This is what a pattern tries to do" [Alexander 1979, p. 260].

We used an artifactual approach to pattern mining, i.e. observation and analysis of project results. Many of Alexander's architectural patterns have been induced by this method: by studying existing buildings. Many software design patterns are developed using this approach [Buschmann et al. 2007] by contrasting and comparing similar systems [Rising 1998]. The *Rule of Three* states that a solution should be found at least three times in different systems to qualify as a pattern. The rule of three has been popularized in the pattern community as documented through Ward's Wiki, referring to Biggerstaff and Richter [1987] rules for assessing the reusability of frameworks. From an epistemological point of view, the occurrence of three similar designs is unlikely a chance encounter [Kohls and Panke 2009].

Based on the *Rule of Three* we can assume that a second occurrence of a solution found in a fitness app qualifies the design as a pattern candidate. Another occurrence qualifies it as a pattern. In this case, the pattern candidate was the hypotheses (an assumed invariant form) and another occurrence was a first corroboration.

The patterns are based on recurrent solutions found in five popular fitness applications:

- Seven
- 7M Workout
- 30 Day Ab Challenges
- Ab & Squat
- myfitnesspal

The pattern descriptions include screenshots to document examples of known use cases.

3. JOB DEFINED PROFILE

3.1 Context

Users should do a self-assessment in order to have an Easy Start and Increase Individual Challenges. In this process a lot of data is requested from the user and they may have to provide information that they do not have. Users have to put themselves into general categories such as lazy/very active or eating little/eating a lot.

3.2 Problem

General terms can be very confusing because each individual has another understanding of what this could mean. Being "very active" can mean a lot of things - it does not tell anything about the actual level of activity. However, precise data is needed to recommend appropriate exercises.

3.3 Forces

Quality of data. The quality of the self-assessment depends on the data provided. But people have a tendency to overestimate or underestimate their own skills.

Lack of data. Most people have no exact data about themselves (e.g. is somebody doing hard or light work, how many hours do you move, how many times are you doing activities). Since exact data is missing, many apps try to categorize the activity levels. However, general terms often lead to misunderstandings.

Right level of challenges. Inappropriate assessment can lead to exhaustion and prohibits an Easy Start. Increasing Individual Challenges is also difficult when the configuration is based on wrong user data.

What people know. Very often people know very little about their individual fitness level. However, people know what they do and very often different jobs and activity level correlate.

3.4 Solution

Use job-specific profiles or stereotypes for self-assessment. Jobs often imply levels of activity. They are also quite specific (unlike “lazy” or “very active” which are subjective measures). Hence, job specific profiles could help to define the number of calories that are approved for daily consumption. For example, specific activity levels are associated with certain professions. A bicycle courier is usually more active than a computer scientist. People can imagine the physical efforts of different jobs more clearly than estimating their number of steps or evaluate themselves in a scale (high movement -low movement). People could easily identify with these jobs. To ensure that every user really gets a picture of the described activity level, not only a job profile should be named but also a small sentence for explanation.

For example, instead of “lazy” computer scientist, you could use the phrase “Sits in front of the monitor, mainly in the office”.

3.5 Consequences

3.5.1 Benefits

- Everyone can make a better self-categorization. Job titles are very often quite specific.
- The profile better matches the real activity of a person.

3.5.2 Liabilities

- There is still a lot of variation of activity within one job domain.
- Other intuitive measures need to be accounted for as well.

4. EASY START

4.1 Context

When a user has installed a new fitness app, she/he is eager to lead a healthier life. Now. Being eager she/he jumps into challenges that sound interesting and engaging.

4.2 Problem

Over-confident as well as misinformed users pick challenges on a too difficult level. They will often misjudge, get exhausted soon and do harm to their bones and muscles as they stress them too much.

4.3 Forces

Wrong self-evaluation. When a user is new to the world of workouts, she/he hardly knows which exercises are appropriate. She/he might be too confident.

Day 1 is easy. The first day is easy. Even if a user chooses too difficult exercises, she/he is likely to complete them up to some extent. When you start a new training you have all the energy saved from your lazy life. For example, if you start running today it is very likely to run faster and longer distances as you would expect. However, the exhaustion comes at the next day. It results in strong muscle soreness and a lack of energy to increase the performance gradually.

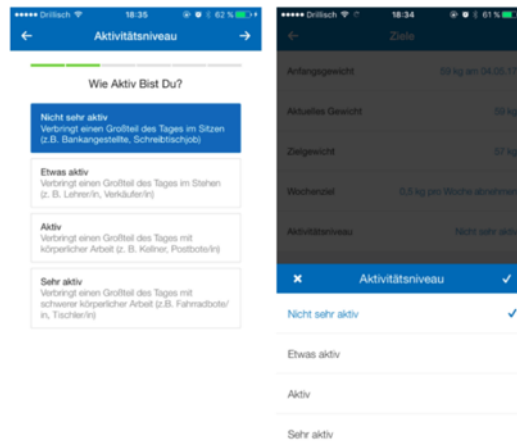


Fig. 1. 30 Day AB Challenges (left) and 7M Workout (right) both offer alternative challenges for different user levels.

Beginners start easy. For beginners it could even be a big obstacle to start doing some simple workouts. Hence, an app has to start at an easy level for beginners.

Motivation vanish. Motivation vanishes quickly if beginners do constantly fail to reach their goals.

Individual skills. Some users are absolute beginners whereas other users have already trained in a gym before. Hence, users have different levels of experience and fitness. On the other hand, exercises vary in level of difficulty. The number of repetitions suitable for the individual depends on prior training.

Wrong goals. The person is going to compare her/his goals with the default goals of the app, without considering these goals were defined for an advanced sportsperson. This could cause that the user will get desperate too early.

4.4 Solution

Design different levels of difficulty, from which the users could start their workouts. The levels could be called “Beginner”, “Intermediate” and “Advanced”. The activities should match the skill and power level of the user, so they could get different numbers of repetitions for the same exercise or exercises of different difficulty. After answering some questions, the user should get a level recommendation. Afterwards he/she should be able to decide for himself/herself whether he/she wants to adapt to this recommendation or wants to achieve more. However, a user with a “beginner” recommendation should not be able to select the “advanced” level to protect them from injuries.

An app should be suitable for beginners as well as advanced users. Moreover, it should accompany users as they progress to become advanced users. Since many users will find it hard to decide which level they belong, you should also offer a self-assessment.

The app should TRACK PERFORMANCES (future pattern) to indicate users that they have progressed and achieved an advanced level. This should be reflected in INCREASED INDIVIDUAL CHALLENGES, and users can be motivated by receiving ACHIEVEMENT BADGES (future pattern).

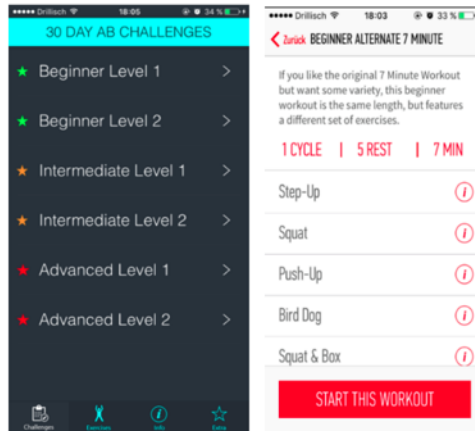


Fig. 2. 30 Day AB Challenges (left) and 7M Workout (right) both offer alternative challenges for different user levels.

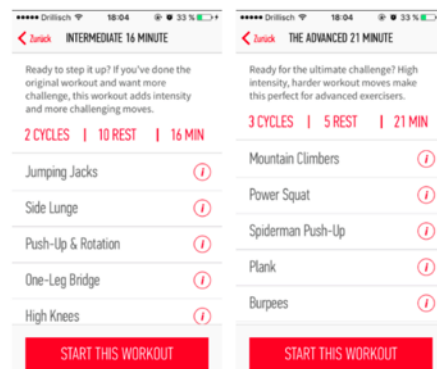


Fig. 3. The screenshots (7M Workout) show a variation of repetitions based on the user level.

4.5 Consequence

4.5.1 Benefits

- Appropriate challenges will lead to successful moments quickly and motivate users to continue.
- On the other hand, users need to be pushed to their individual limits progressively in order to experience flow moments as well as steadily increase the power level.

4.5.2 Liabilities

- A wrong self-assessment can cause users to overstrain themselves, which can in the long run cause many physical injuries. Unfortunately, the body does not signal inappropriate levels of exertion. The body has to ease into higher levels of exertions step by step.
- People are often unsure about their own physical conditions. If users are lost in setting up the configuration. They can be supported by JOB DEFINED PROFILES.

5. INCREASE INDIVIDUAL CHALLENGES

5.1 Context

After a few weeks of using a fitness app, a user becomes more and more advanced. She/he can manage the exercises with greater ease than in the beginning. She/he gets bored because she/he is no longer challenged.

5.2 Problem

Excitement decreases when a user gets used to exercises and is no longer challenged to achieve goals. Motivation decreases. Eventually the user stops using the app and quits the workout program.

5.3 Forces

Getting better. At the beginning the user will only reach a low number of repetitions, have simple goals or use easy exercises. Day by day this number could grow and the performance could increase. This is exciting, we are getting better! But wait, it's getting boring. We know we can achieve the easy goals. There is no more challenge for us.

Excitement. To keep moving, we need constant excitement and motivation. There will be a deficient in interest, stamina, and self-discipline when people lose their interest. The flow experience gets lost if things are too easy.

Frustration is waiting. When a person decides to live a healthier life, she/he could think about doing some workouts. At the beginning this person might be quite motivated. After doing her/his first workouts, this motivation can be reduced because she/he could not reach as many repetitions as she wanted to reach. Or she/he fails to complete difficult or complicated exercises that require a lot of body control.

5.4 Solution

Adapt individual challenges progressively based on previous performance. Individual challenges motivate the users because they match their own level of skill and power. This could be more effective if the enhancement and the path of success will be documented (e.g. in a graph visualization or achievement badges). If the user also sets a goal, which increases stepwise the number of repetitions or the level of difficulty of an exercise, the ebbing of motivation could be prevent or delay. Moreover, the goals could be expressed in more vivid ways like getting a "bikini-body" or a "six-pack".

5.5 Consequences

5.5.1 Benefits

- Interest of doing workouts will be preserved for a longer period of time
- The workout fits better to the person
- Individual achievement goals can be respected

5.5.2 Liabilities

- Mapping individual achievements to challenges is a complex activity. Simple processes can actually lead to wrong recommendations or workouts.

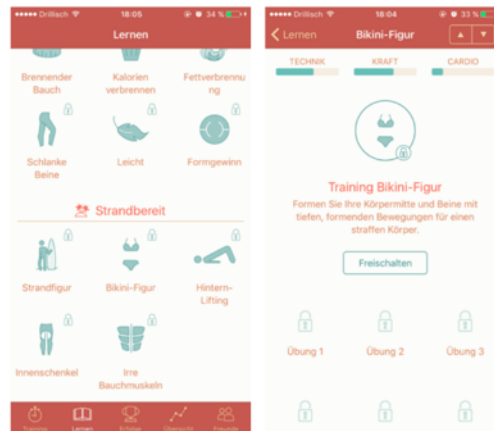


Fig. 4. Individual challenges are based on previous performances and individual user goals (such as Bikini shape, six pack).

6. DO IT RIGHT INSTRUCTION

6.1 Context

Fitness apps teach novices and advanced sports persons how to achieve their goals and perform appropriate exercises (based on EASY START and INCREASE INDIVIDUAL CHALLENGES). The exercises can be performed at any time, at any place and they are not supervised by a professional coach.

6.2 Problem

Incorrect execution can cause serious physical injuries. Without a supervisor the chance for incorrect performances increases.

6.3 Forces

Do it anytime, anywhere. It is hard to procure some time off. And if there is some time off, people spend this time reluctantly in a gym, because of the fact that they would be constrained to the opening period. If they can't go to the gym, they can't have a personal trainer and have to do their work out on their own.

Pain comes later. It might seem to be insignificant when exercises are not performed 100% correct but in the long term exercises performed incorrectly can cause grave physical injuries! The trouble is that such injuries do not show up right away. Hence, users are not aware that they are doing something wrong. Usually pain signals us that something is going wrong. However, when we feel pain it's already too late. Only serious incorrect motions cause immediate pain.

Do what...? Professional terminology is needed to understand some instructions but novices often do not know the meaning of this terminology. Some people do not even know what the biceps is. Hence, referring to "biceps" is pointless to them.

6.4 Solution

Provide clear textual and visual instructions without difficult terminology. These instructions should exactly clarify where to pay attention to when doing the separate exercises. Moreover, point out common mistakes and dangers. Videos are a particularly powerful medium to demonstrate the correct motions.

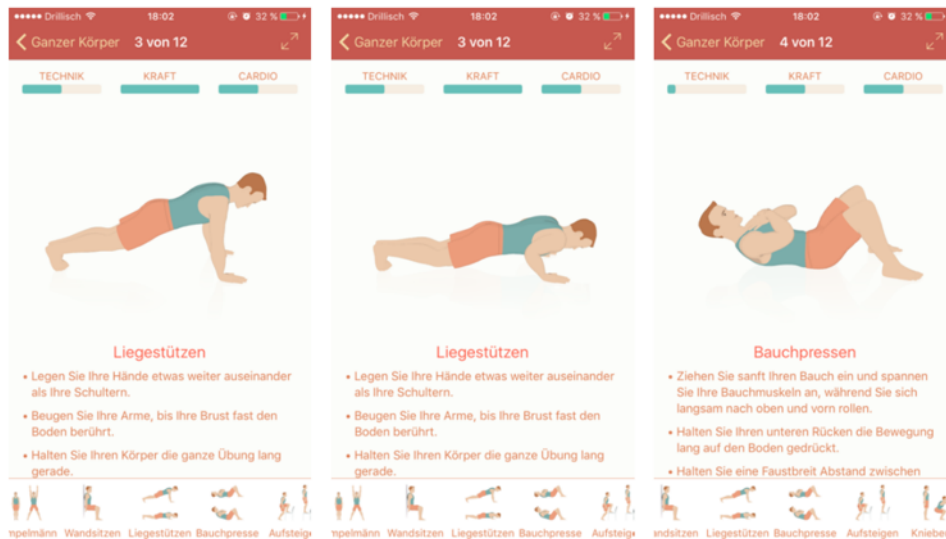


Fig. 5. The app 7M workout provides detailed instructions and depicts all different states of motion. A simple and clear language provides instructions.

6.5 Consequences

6.5.1 Benefits

- Physical injuries of users caused by wrong performance of the exercises can be reduced.
- People no longer depend on a personal trainer who has to show them how to perform exercises correctly.

6.5.2 Liabilities

- Videos could still be misinterpreted because they provide no feedback. To show the exact motion it is often required to use different camera angles. This could increase production costs significantly.
- Users could feel a misleading confidence in their own skills if they receive no feedback from a professional training. They may think that they are doing the exercise as shown, but they could still make mistakes. These repeating mistakes can cause significant physical injuries.

7. CALL FOR ACTION

7.1 Context

A user has realized that she/he needs to lose weight, that her stamina eased of and that she/he not working out for a long time. She/he has decided to change this situation and do some workouts. An app provides her with practical suggestions and a workout plan. Still, she/he drops back to her old habits.

7.2 Problem

Old habits are hard to overcome. It needs a lot of will power to overcome old habits, and there are many seductions to get off track again.

7.3 Forces

Distraction. People rather meet with friends than doing some work out. They forget about their good intentions. But it is important to stick to an exercise plan continuously to achieve goals.

Lack of time. People are too busy and have not got enough time to do some exercises. They are too stressed in their workaday life. They do not realize the amount of time that has past, and soon enough it is getting too late for a visit in a gym.

At the right time. People do not always have enough space or are in the right place for doing some exercises. Hence, when there is an opportunity (some time left, being at the right place), they should be triggered to do some exercises.

Persuade. A coach or personal trainer persuades sportsmen to do exercises. But few people can afford a personal trainer. Even if you have the money, a personal trainer cannot always be around.

Allurement. People abandon themselves up to the temptation too fast and disobey their predefined rules. A lot of willpower is needed to constantly focus on one's own intended behavior change.

7.4 Solution

Push notifications to remind people of upcoming exercises, and remind them to execute their workout plan. This nudges people to take actions. They are reminded and invited to act.

All day long the user would know that there is an exercise to do. Still she/he needs a trigger. Nevertheless, a notification can also disturb the user at the wrong moment, when it shows up in an inappropriately time or place. So the person should be able to press a "snooze" button to delay the exercise for a few hours.

Furthermore, a person should know at which time he is generally at home, so she/he can set the notification at about that time slot. If this is still an inappropriately time, she/he could use the "snooze"-button.

In this case, "snooze" does not mean that the exercise is simply pushed away. Each further alarm becomes louder or vibrates longer. It should also be harder to press the "snooze"-button.

For example, after pressing the "snooze"-button a warning can be sent out that an image of the user will be published in a popular social media platform. This image is a picture that was previously stored in the backup of the app, which shows the user and has been prepared using a revision tool to make the user look at least 30 kg heavier.

7.5 Consequences

7.5.1 Benefits

- An advice note that reminds you to do something could be very helpful, especially for beginners.
- When the beginner becomes an advanced, she/he would be reminded by her/his conscience, because of the fact, that e. g. the daily work out could become a routine.

7.5.2 Liabilities

- To get a message or a notification from an application could be nasty, if it is triggered in an inappropriate moment (time or place).
- When the user has read the notification, she/he would get bad conscience if she/he ignores it.

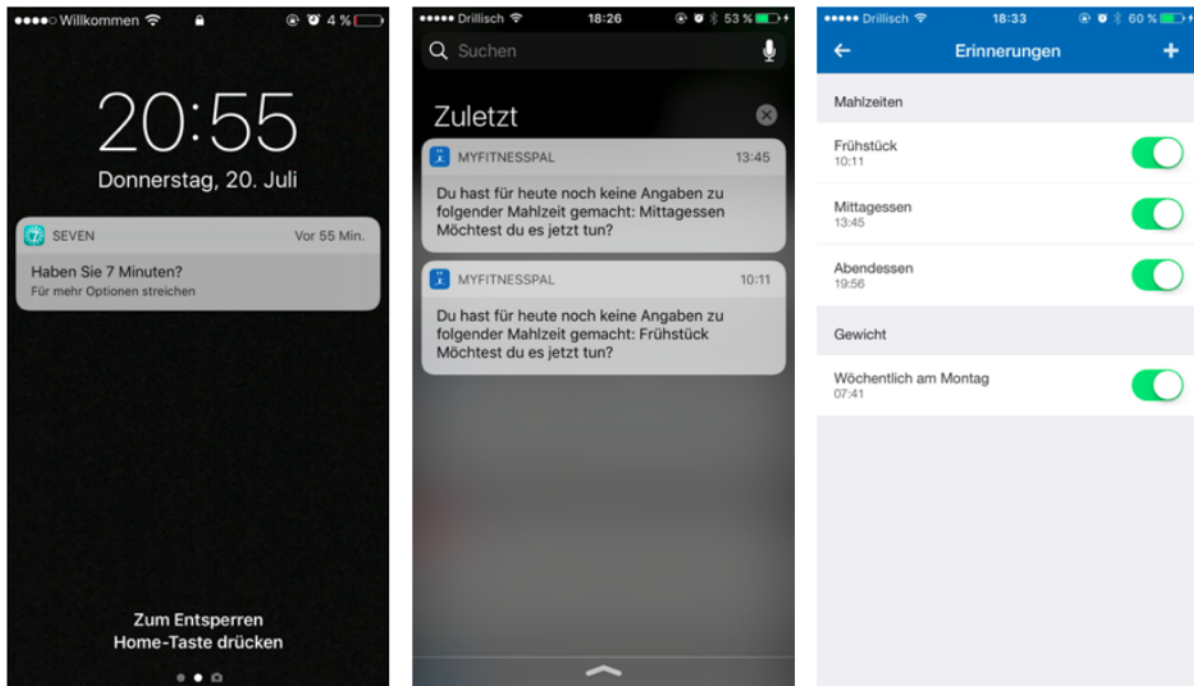


Fig. 6. The app 7M Workout (left) asks users frequently if they have 7 minutes. This is a short time slot and people can sneak short exercises into their daily routines. They can also postpone the workout. The app MyFitnessPal (middle and right) reminds users to add data about their daily meals and enter their weight frequently. Users can add their own reminders.

8. CONCLUSION

In this paper we have presented five patterns for designing fitness apps. The patterns are based on good solutions found in existing fitness apps. These good solutions are based on our own experience. However, since it is not enough to have tested and evaluated these apps, a study is planned in which ten to twenty people will test the five apps we have chosen over a longer period of time. After two weeks each of the participants has to select a suitable app from these five and explain why the other four were rejected. Afterwards, they will be asked about a number of questions every two weeks. These questions may include, but are not limited to, the following: “Have you completed the exercises you have been requested to do?” “How did you overcome yourself to do the exercises?” “How descriptive were the explanations for the exercises?”. These good solutions can help users to understand the usefulness of specific features. They can also use the patterns to express their expectations for a virtual fitness program. Developers can use the patterns to improve their existing apps or design new fitness apps altogether.

We have identified several more patterns that will be described in future papers, including:

COUPLE YOUR APPS: Users should have the possibility to send their achievements (such as daily steps) to other apps in order to account them.

BEAT YOUR FRIENDS: Connecting with friends to challenge them, can help increasing the motivation of doing some workouts. These challenges could be the number of repetitions or the type of the exercise.

GOAL PACKAGE: Users can define their individual goals such as super bikini body or fit into wedding dress, super six pack, or Good Bye Beer Belly. Exercises which are especially for the concerned area of the body could be applied to get the best result.

ACHIEVEMENT BADGES: Visualizing achievements by providing badges.

TRACK PERFORMANCE: Capture and track the performance of users either my manual input of data or automatic measurement using the device's sensors.

SCHEDULE SPECIFIC PROFILE: People do not always have the same daily routine. Teachers, for example, move less during vacations than during the school time. It should also be possible to record and schedule this rhythm.

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