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# Look at Me, Coach: A Trainer's Critique of Mobile Apps for Weight Training

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**Abstract**

The intersection of two contemporary trends – interest in fitness as a healthy lifestyle and the multitude of smartphone applications that seem able to serve any of our daily needs – was bound to produce an “explosion of health and fitness apps” [1]. But how well do these apps support the regimen of areas such as strength training or weightlifting, which are seeing significant growth and interest amongst the general population? The training exercises within weightlifting require the careful supervision of a certified coach to ensure optimal performance of the trainee and to reduce the risk of injuries.

In this paper we conduct a preliminary survey and critique of existing mobile apps in support of weight training. We present this both from an interaction design perspective, and from the needs identified by specialized coaches working with athletes and the general public at a high-performance training centre. We conclude with design recommendations for interactive mobile apps to support both trainees and coaches of weightlifting, and issue a call to the HCI and Sports community to focus some of its design and research efforts to this app-deprived area.

## **Introduction**

While health has always been a concern for most people, fitness as an essential component of a healthy lifestyle is a topic of increased awareness recently. Amongst the fitness trends, strength training and in particular weightlifting is receiving significant attention, moving from being the exclusive domain of high-performance athletes to having a wider appeal, as demonstrated by the increased popularity of high-intensity interval training (HIIT) or cross-training.

While until recently the attention to fitness was mostly visible in "traditional" media such as TV and printed magazines, the ubiquity of smartphones in all aspects of our lives reflects in the fitness space as well. A variety of dedicated apps can help gym-goers keep track of their milestones, share them with friends, receive suggestions about new routines, or subscribe to exercise regimens curated by various service providers [2]. These are truly ubiquitous: 19% of smartphone owners use a health and fitness app [1]. However, most of such apps act as a mere (albeit more convenient) replacement of traditional tools such as paper logbooks or fitness routines published in magazines. Very little support is offered for the actual training (e.g. adapting intensity to a certain regimen, correcting body posture). This is particularly evident in weight training, where the presence of a coach is critical to ensure that proper form and kinematic patterns are followed.

In this position paper, we share the results of a survey we conducted as part of our quest to find a video-based mobile app that would support the weight training coaches at the Synergy Training Centre in Fredericton, Canada. The survey is a preliminary step toward establishing a set of user-centric design

recommendations for interactive mobile apps to support both trainees and coaches of weightlifting.

## **The need for trainer-centric video-based mobile apps**

Synergy is a high-performance centre dedicated to training elite athletes from various sports, as well as amateur athletes who choose weightlifting as their strength and conditioning activity. Under the coaches' supervision, athletes follow a training regimen personalized to individual needs. In a typical setting there are 5 to 10 trainees and 1 to 2 coaches. The coaches move around, advising and assisting trainees. This offers a balance between athletes working on their own and one-on-one personal instruction.

Since weight training requires coaches' constant attention, handling several athletes at the same time represent a significant workload for coaches. Due to the nature of this sport, coaches need to ensure that athletes receive proper feedback on their technique as well as dynamically adjust their routine when needed. Video recording has the potential to not only alleviate some of the workload issues faced by coaches, but at the same time provide them with an additional instructional aid, in the form of an "after-action" review tool. Ideally such reviews could be conducted both when the coach is present but also remotely.

In our own experiences (and similar to many other training centres, as seen in [3] or [4]), we have begun using smartphones and tablets for video capture and reviewing. We share here the results of our survey and testing of mobile apps that support this, and draft a preliminary set of design and feature recommendations for a coaches-centric weight training app.

### **Design and feature recommendations**

Only so much information can be observed on first viewing of a fast movement that require specific joint positions at different times. For example in the sport of weightlifting, the Olympic Snatch is considered one of the fastest movements humanly possible considering the large amount of weights being lifted. The entire lift takes approximately a second, with very little time to observe specific portions of the lift ([5]). Analyzing software would allow the coach or user to see specific portions of the lift, the speed of certain portions of the lift, and be able to compare joint angles and bar path with an ideal movement ([5] suggest this be done through manual calculations based on recorded video). Based on these observations, we have organized our preliminary recommendations into several categories:

#### **Medium**

An app supporting coaches' activities must be able to record athletes' exercises. For this, video is the most suitable medium (both captured in-app and coming from an external source).

#### **Feedback**

Coaches must be able to provide the most comprehensive feedback to their trainees. For this, the app must support a wide range of feedback options, both in graphical form, but also as audio and text annotations that are time-aligned with the recorded video. Furthermore, as one specific exercise is repeated several times in a set, comparison between recorded videos of the same exercise must be possible – ideally with side-by-side, time-aligned, video playback.

#### **Editing and playback**

Being able to edit the recorded video inside the app and customize the playback (e.g. slow motion) should allow

for instant reviews of the recordings without the need for additional equipment.

#### **Sketching**

Coaches often use whiteboards to sketch elements of the training routines, such as examples of proper body posture. The ability to superimpose such sketches over the recorded video could provide coaches with a valuable teaching aid.

#### **Measurements**

Highly-specialized training centres such as those typically associated with university-based research labs have the capability to conduct various kinetic measurements (e.g. angles of joints, force exerted by muscles). However, such equipment can be financially inaccessible for non-research training centres. While sketching over the recorded video can offer an acceptable compromise, ideally some or all of these measurements should be automatically determined through computer vision-aided video analysis, with minimal user intervention.

#### **Usability**

A coaches' app should be easy to use and account for the challenging environment for which it is built (e.g. on-screen explicit controls with large target buttons to accommodate use while in motion or while holding a device in a difficult position).

#### **App reviews**

The coaching staff at Synergy Training has conducted a survey and evaluation of available apps that provide support for weightlifting coaches<sup>1</sup>. The evaluation (conducted in our training centre) was limited to

<sup>1</sup> Disclaimer: neither the Synergy coaches nor the authors of this paper endorse any of the apps reviewed here, or have any commercial or other financial interest in these apps.

Android apps not requiring additional equipment (e.g. arm or leg band for kinetic measurements, as for the Pulse fitness app [6]). Five apps were identified in the Google Play store (<https://play.google.com/store/apps>). Of these, one was not reviewed due to compatibility issues. The rest are reviewed in Table 1 using the criteria drafted in the previous section. The Apple iTunes store had one additional app (Ubersense <http://www.ubersense.com/>) that is not available for Android, although its functionality appears to be similar to that of some of the Android apps.

### **Discussion and Conclusion**

Weight training is receiving significant attention in recent years. However, in contrast to general fitness, it is relatively underserved by mobile applications. This is particularly evident for apps that support weightlifting coaches. In this paper we have drafted a preliminary set of design and functional recommendations, based on our own coaching experience. Some of the functional needs are inherently complex – such as tracking the motion, and ideally, speed, of the weight bar and of the trainees joints. This complexity can be one justification for the dearth of weight training-specific mobile apps. As illustrated by our survey, no single app addresses all of our design recommendations for supporting weightlifting coaches through video-based analysis. We hope that this preliminary analysis will further the interest of the HCI and Sports community in the development of user-centric design recommendations for mobile apps to support both trainees and coaches of weightlifting.

### **Authors' biographies**

Cosmin Munteanu is a Research Officer with the National Research Council Canada, and an Adjunct

Professor with the University of Toronto. His research is dedicated to improving humans' access to and interaction with information-rich media and technologies through natural language. Presently, Cosmin leads several academic and industrial research projects that explore multimodal interaction for mobile devices and mixed reality systems. Outside the lab, Cosmin is a dedicated hockey player and a member of the Synergy Training Centre where he follows a hockey-specific strength and conditioning training regimen.

Trevor Pardy is a Certified Strength and Conditioning Specialist and Olympic lifting coach at Synergy Training Center where he works with athletes from the development level to the elite level. For the past 5 years, he has worked with the University of New Brunswick Varsity athletes. Trevor has a BSc in Kinesiology degree with a focus on the biomechanics of movement and functional anatomy.

### **References**

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- [5] Bartonletz, K.E. (1996). Biomechanics of the Snatch: Toward a Higher Training Efficiency. Strength and Conditioning Journal, v. 18 n. 3.
- [6] CrossFit Toronto (2013). PUSH Strength Interview with Co-Founder Mike Lovas. 24 Dec 2013.

Design criteria	App			
	Coaches' Eye	Barsense	Platform Helper	SKLZ Cam
Medium	(-) Limited 3 <sup>rd</sup> party formats	(+) Any video from the device's library	(+) Any video (-) Cumbersome video loading dialog	(-) Only in-app recordings
Feedback	(+) Audio annotation (voice-over-video) (+) Side-by-side viewing	(-) No voice-over annotations.	(-) No feedback	(+) Voice-over annotations (+) Side-by-side viewing
Editing and playback	(+) Slow motion playback	(-) No slow motion	(-) No slow motion	(-) Limited editing and playback, without undo option (+) Slow motion
Sketching	(+) Sketch over video (synchronized with audio annotations)	(-) No	(-) No	(+) Sketch over video that can be shared as a separate video
Measurements	(+) Can track angles of joint positions based on users' sketches. (-) Doesn't track objects automatically (thus unable to measure speed of weight bar).	(+) Can track trajectory and speed of user-defined areas (such as the weight bar, using the plate size to determine distance)	(+) Can track the bar's path and determine instances of maximum velocity based on user's positioned on-screen crosshair using computer vision algorithms (-) No measure of actual velocity	(-) No measurements

Table 1: Summary of features present in coaches' apps available for Android. For each app its features are assessed with respect to the higher-level design criteria as missing (-) or present (+). Overall we found that while all apps could be used in a gym environment, their usability was highly dependent on the screen size and more appropriate for larger screens (e.g. tablets).