DIY: Potentials of self-made sports gadgets

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Abstract  
Today, people make use of technology that involves body movements everyday: they control games using their whole body and they track their moves to analyze their behavior. Collaterally, there is a movement that lets people create their own stuff: Do It Yourself (DIY) undergoes another uptrend by using digital media. In our research, we combine these two fields and let people create their own devices that capture body movement and transform these data into personally relevant information like feedback about quality or quantity of the movement. Here, we take a look at 17 artifacts that were built during workshops with young people regarding to three aspects: purpose of the devices, movement capturing, and diversity of the built artifacts.

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DIY, construction kit, sports, exercise, gadget

ACM Classification Keywords  
H.5.m [Design, Human Factors, Information interfaces]: Miscellaneous

General Terms  
Design, Human factors
Introduction
Today, workout can be accompanied by technological systems that measure physical activity, calculate calory consumption and report on progresses and personal behaviour. Sensors in shoes, in cellphones and in wristbands have become companions for running, biking, hiking and more. That way, systems like Nike+ [9], O.Synce [10] or Fitbit [5] help people to analyze their training.

The existance of technologies like these indicate that people are interested in their training data which might be due to different reasons: motivation, comparison or simply curiosity. On the other hand, even if they provide possibilies for multiple usage, systems are limited to specific movements and/or sports. Athletes are consumers of these technologies that are ready-to-use for their specific purpose.

On the contrary, the revival of DIY or “making” allows to create technology for personal needs. That way, people are not reliant on existing systems with all their restrictions but they are free to invent tools according to their personal interests and needs. So, the questions arise, if there is a possibility to combine DIY with body movement and if so, what kinds of devices do people create?

We have composed a construction kit that allows young people to create their own devices. In four workshops the kit has evolved iteratively. During these workshops the youngsters have developed their own devices. Here, we focus on these developed artifacts and look at them from different points of view: What are the purposes that the artifacts are supposed to answer? How is body movement captured? And: Does this approach allow to create diverse artifacts?

The TechSportiv-System
The system that allows people to invent their own movement measuring tools and gadgets is called TechSportiv and is refered to as a construction kit. It contains hardware material, such as sensors, a microcontroller, and actuators, an easy-to-use graphical programming language and further a workshop environment in which young people are empowered to become inventors of their own systems [4].

Construction kits have become popular in educational contexts as they allow even young people to invent robots and other gadgets and to learn about technology as well as other topics at the same time [8], [12]. A well-known example is the LEGO Mindstorms construction kit [7].

The evolution of the Arduino LilyPad and Smart Textiles [2], [3] allows to bring technology construction together with your own body. This connection allows to create personally meaningful objects on the one hand [6], [11] and on the other hand it constitutes the starting point for a construction kit that can be used for sports applications. Hence, the TechSportiv Kit includes Arduino technology [1].

The TechSportiv-system was developed during four workshops with young people aged eight to 15. One of the workshops took place as a weekly focus group meeting with three participants only, whereas the others were three- or five-day events with 11 to 15 participants each. The workshops were accompanied by researchers and students who observed and interviewed the attendees for evaluation purposes.

Classification of the developed artifacts
During the four workshops 17 artifacts were developed by the participants. They are mostly motivated by the
youngsters’ curiosity about their own abilities, the comparison to others or own former performances, or the incentive to improve one’s own performance. For example, three boys created a special soccer shoe that measures the intensity of a shot by using pressure sensitive resistors on the surface of the shoe. The intensity is then displayed on a scale of three LEDs that indicate low, middle and high intensity. The boys described their idea that way: “[…] We like to play soccer and we also play in a team. Then we thought about it and had the idea when one said he could shoot hard but it was not hard, we wanted to prove him that it was not hard. Then we had the idea with the shoe, that’s it.” (Leon, 11 years, translation) Two other boys invented an indicator that displays the quality of their caster board performance. An accelerometer is attached underneath one footpart of the board and two LEDs indicate whether the movement is steady-going or not in two different situations - while moving forward and while turning.

While the first example, the soccer shoe, displays the quantity of the movement - how hard the ball has been shot - the caster board artifact addresses the quality of their caster board performance. An accelerometer is attached underneath one footpart of the board and two LEDs indicate whether the movement is steady-going or not in two different situations - while moving forward and while turning.

While the first example, the soccer shoe, displays the quantity of the movement - how hard the ball has been shot - the caster board artifact addresses the quality of their movement - riding smoothly or not. That way, we classified the 17 built artifacts into four different groups that are identified as quantifying movements (53%), indicating quality (21%), assisting the performance (16%) and last a category called artwork (10%), where movement is translated into some other representation like music or blinking LEDs. Figure 1 shows the classification of the artifacts regarding to their purpose. Some of the 17 artifacts can be assigned to more than one group. As an example, one girl built a device that helps others to unicycle. Therefor, it starts vibrating when people get out of balance to warn before they fall. Hence, it assists the unicyclist while performing and displays the quality of the movement at the same time (a good performance is when it does nothing).

Further, we take another perspective and group the artifacts by the question where the movements are captured. This can be done either directly where it happens, on the athlete’s body, or, indirectly, on the piece of sports equipment. The unicycle project is one example out of two that is attached on the body and on the equipment at the same time. Our data show that two out of three projects capture the movement on the athlete’s body (see figure 2).

Regarding to the question of diversity we want to give a short overview on the types of sports that the artifacts address and thereby show the potentials of the system to meet diverse interests. Artifacts that are to be used for boxing, caster boarding, fencing, long throw, ring gymnastics, soccer, trampolining, unicycling, walking, and others were built. From these varying applications we infer that the system holds the potential for diversity in constructing own gadgets.

Conclusions
We have reported on a system that allows athletes to create their own sports gadgets to measure their movements and to provide feedback on it. Four workshops where the system has been developed and applied have led to 17 different project prototypes that we analyzed regarding to their purpose, the positioning of measurement, and the diversity amongst the artifacts.

With these results we have shown the feasibility of letting athletes create own technological gadgets for their training. Further we see that sports gadgets are an interesting application for non-experts’ technology construction.
While today's purchasable technology focuses on some few types of sports, the presented approach shows a more widespread area of application. Hence, we conclude that a DIY construction kit for sports opens up new ways to invent more and especially more diverse gadgets than today's commercial applications. Future inventors could be hobbyists but the approach could also be applied in participatory design processes in companies that invent these tools for sale.

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References