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1-1-2012

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Recommended Citation
Lee, V. R., & Drake, J. (2012). Physical activity data use by technoathletes: Examples of collection, inscription, and identification. In J. van Aalst, K. Thompson, M. J. Jacobson & P. Reimann (Eds.), The Future of Learning: Proceedings of the 10th International Conference of the Learning Sciences (ICLS 2012) (Vol. 2, pp. 321-325). Sydney, NSW, Australia: International Society of the Learning Sciences.

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Physical Activity Data Use by Technoathletes: Examples of Collection, Inscription, and Identification

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Abstract: The proliferation of physical activity data monitoring devices had led to an increase in *technoathletes*—individuals who combine athletic training and performance with the collection and evaluation of personally-relevant data in an effort to better understand their own abilities. We interviewed 20 technoathletes who were actively involved within either cycling or running communities. Qualitative vignettes of technoathletic engagement with data and the practice of data logging, in specific, are discussed and illustrated. Individual relationships that technoathletes have with their data are also examined. Through the examples, we highlight some commonalities in the data that were obtained and how various athletes represented that information. We also consider some of the tensions that technoathletes have with respect to the data they can obtain and how they saw themselves in light of their data and consider some implications for instruction.

Introduction

A distinguishing characteristic of research in the Learning Sciences has been a continual interest in how individuals develop proficiencies and become active participants in authentic practices. When researchers began to appreciate that cognition and learning were both inherently situated phenomena (Brown, Collins, & Duguid, 1989; Greeno, 1998; Greeno, Collins, & Resnick, 1996), they took notice of studies that showed the nuances of how people reasoned and used the associated "disciplinary" knowledge in real-world settings. For example, everyday mathematics research has illustrated nuances of computational processes of dairy work (Suchman, 1987), grocery shopping (Lave, Murtaugh, & de la Rocha, 1984), candy sales (Carraher, Carraher, & Schliemann, 1985; Saxe, 1988), basketball (Nasir, 2000), and the work of high status professionals (Hall, Lehrer, Lucas, & Schauble, 2004; Stevens & Hall, 1998).

Considered together, this body of research related to everyday knowledge and everyday practices has helped to illustrate for us the breadth of prior understandings that individuals (often, but not always, children) possess. As learning scientists, we often maintain the beliefs that those everyday understandings should be harnessed and developed through instruction, or that they should serve to help us identify practices that can be targeted through instruction. Over the past few years, we have been involved in a research and development program that involves identifying data gathering tools and technologies developed for use by athletes and fitness enthusiasts and integrating them into K-12 instruction (Lee & DuMont, 2010; Lee & Thomas, 2011). These tools, which we refer to as Physical Activity Data (PAD) technologies, piqued our interest in part because they allow for flexible use in a variety of activity contexts. We also appreciated their ability to collect large volumes of data very quickly that could be re-represented in a number of visualized formats. However, our work thus far has only considered the use of these technologies within designed instruction. In the present paper, we are interested in better understanding their use in actual practice.

Theoretical perspective

In following with the work described above related to everyday and situated cognition, we are concerned largely with how people engage in the authentic – "ordinary practices" (p. 34, Brown, et al., 1989) – of athletic cultures. Furthermore, we consider ourselves as inquiring into and documenting routines within athletic communities of that embrace *technoathleticism*—a strand of athletic activity that we see as melding physical training and exercise routines with the practices associated with collection and examination of information taken from data gathering technologies. For this work, we consider the possibility that activities such as bicycling or running could be central and defining for particular athletic "communities of practice" (Wenger, 1998). An effort to understand these communities would require gathering reports and artifacts from informants who have maintained sustained involvement and participation, as well as records of knowledge sharing through sanctioned organizations and social groups. Therefore, thinking of technoathletes as residing within and as part of athletic communities of practice strongly influences our methodological approach. Part of our work here is to understand data collection, inscriptions, and identities that are formed by participants in such communities, including potential regularities with respect to technoathletes' use of data. We anticipated regularities with respect to how data are aggregated, organized, and represented. Furthermore, we hypothesized that it is during these acts of reflection and inspection that meanings were assembled in alignment with physical activity data such that new understandings about performance or selves could emerge (e.g., Lee & DuMont, 2010; Nemirovsky, 2011).

Data Sources and Analysis

Were we to follow some of the models of existing research related to everyday cognition (e.g., Wenger, 1991) then a long-term, ethnographic approach would have been ideal. However, because of the advanced skill level of many of our participants and the nature of their activities, which often involved major endurance activities over long distances (e.g., competitive marathon running, two hundred mile bicycle races), we opted to limit our data collection to interviews. We recruited 20 adult technoathletes to meet with a researcher for roughly one hour. These technoathletes were recruited through local sports equipment stores, running and cycling clubs, and word of mouth. All of the participants resided in and participated in athletic activities in Utah, a state in the US Rocky Mountain region known in part for abundant access to outdoor and endurance activities. The participants ranged in age from early-20s to mid-60s. In total, we recruited eleven technoathletes who identified primarily as bicyclists, eight who identified primarily as runners, and one who identified strongly with both activities. Ten males and ten females participated in this study. Most of the participants were college-educated.

Prior to the hour-long videorecorded interviews, we arranged for the individuals to bring and share any devices or materials related to their use of physical activity data. During interviews, we asked these individuals to share their history leading to their involvement in their selected sport (running and/or bicycling). We then reviewed the PAD materials the individual brought. We also provided an internet-connected computer for any individuals who wished to show web services they used for tracking activity data. We also posed questions to these individuals about mechanical systems and comprehension of speed data, which we will report upon in future work. For this paper, we only report on the individuals' described participation in their sports and their collection and use of physical activity data.

After collecting the interviews, we examined the video records and any collected artifacts (i.e., computer files or training documents) and catalogued the technologies that these individuals used, the data that they collected, and the manners in which they reported that they related to their data. For example, we documented instances of data organization and then examined if and when data collection was in service of training or a means of gaining personal insight. We identified themes salient to a subset of interviewees then engaged in a process of progressive hypothesis refinement (Engle, Conant, & Greeno, 2007). As we broadened our examination to the entire corpus, we identified several representative transcript excerpts and subsequently subjected them to repeated video review and interpretation. In this paper, we present brief excerpts—a collection of short "case vignettes"—to illustrate some of our findings thus far.

Findings and examples

In this section, we present excerpts from interviews that illustrate some of the understandings and practices that our sample of technoathletes reported. However, to help orient the reader, we first provide some additional background about what initially attracted these individuals to their respective sports.

The individuals in our sample typically established and maintained active participation in their sport for any of three, non-exclusive reasons. First, the individual had followed an established trajectory from earlier in their lives. Typically, these athletes had participated in an organized sport in high school or college and were already physically active; they sought to continue an active lifestyle as an adult through running or cycling. Another reason for involvement was that the individual was introduced to their current sport through a personal contact, such as a friend, family member, or neighbor. Half of the sample reported that a personal friend or acquaintance influenced their involvement. This influence varied in levels of intimacy. For some, it took the form of coworkers who suggested commuting to work together on bicycles. For others, it involved the desire to spend more time with significant others who were already active in the sport. Finally, some individuals reported becoming involved in their sport due to a perceived medical necessity.

All of the participants participated in athletic community-sanctioned activities, such as annual races or riding/running groups that met weekly or monthly. All had also adopted some form of PAD technology. A few individuals simply used their iPods or smartphones to track their running time and distance, often with the aid of training or recording apps that could record splits or use GPS technology to map their trails. One individual used only an Omron pedometer in her training and daily exercise. Runners who had been participated in formal competitions often used watch-based device suites to track speed and distance. They placed a premium on speed and distance information. For cyclists, the device of choice was some form of bike computer, manufactured by companies such as Garmin or Blackburn, which could be attached to their bicycle to track speed, distance, and cadence. All but one cyclist in our sample owned or had used some form of cycling computer. Across both groups, there was a mixed opinion about heart rate monitors, as heart rate is understood as being strongly associated with specific training philosophies.

Sixteen of the twenty participants (80%) reported experiences with data logging. These technoathletes either used web services that stored their information or created and maintained personal logs of their runs or rides. Sometimes these were in the service of a training regimen for a planned competition, but for others, it was simply a habitual activity to learn more about themselves. Below we present some examples to illustrate the design and use of these logs as tools for extracting meaning about physical activities and performance.

Additionally, we heard from these individuals about variable relationships they had with the data they collected. In some cases, the collection of data allowed them to view their capabilities or performance in a new light. In others, the data became a source of irritation that they sometimes had to separate from in order to enjoy their sports. Examples of both are provided in the sections below.

Physical Activity Data Logging: Collecting and Inscribing

Creating a wide range of inscriptions with data from physical activities was a common practice among technoathletes. Those who had only begun to use PAD devices in the past few years tended take advantage of software tools that were bundled with their PAD devices and simply upload their data into those systems. These tools could generate graphs, maps, and tables. Others, like Thomas (a cyclist in his 40s who had been riding competitively for several years), began with a detailed tabular logging system but later came to use simpler means. Thomas simply used a free wall calendar, which he filled in each day with route and distance information related to his cycling.

Thomas did not consider himself an active user of these data. Rather, logging was simply a habitual activity for him that he continued throughout his years of cycling. However, even though he did not consider the logging as central to his cycling activity, he did maintain years of logs and reported occasions when he would still use them to make self-evaluations.

> T: There's times I've gone out and, especially at the beginning of a year and rode and thought "oh man I'm just not up to snuff," or else I think I'm doing extra good but if I can go back and say well okay last year, you know, I was about in this range, about normal or I'm ahead or behind or whatever. It kind of helps me gauge where I'm at, you know, knowledge is power, I guess. And so I kind of always know where I'm at.

For Thomas, the calendar and the data he kept in it served as an important artifact to help him recognize what was normal for him, particularly at the beginning of the training season when his most recent ride memories were of rides at his seasonal performance peak. It was a highly personalized evaluative tool against which he could compare himself relative to different times in the year.

Another example of log use came from David, a competitive marathon runner in his 50s who used GPS technology and a heart rate monitor. He maintained two spreadsheet logs, one for his race times and the other for automatically recording his training runs. In his race log file, he noted the date, the name of the run, the type (10K, relay, marathon, etc.), his time, pace, placement in his division, and his placement overall. He also calculated and recorded his percentile rank relative to all other participants in the race. David also frequently recorded whether or not his time would qualify him for the Boston Marathon. Though he had no immediate plans to compete in the Boston Marathon, he viewed a qualifying time to be a notable achievement for a given race. As he described it, Boston was seen as an important venue within the broader distance running community, even though David was only participating in and had logged races in the Rocky Mountain area.

Aside from using his log to evaluate his performance relative to peers and against an accepted community standard (Boston qualification times), David also used his log as a tool for setting his performance expectations. As it happened, our interview with him fell on the day before a local half-marathon.

> Int: Well, based on this, or whatever you've been doing, what do you think your Run the Rockies [the upcoming race] is going to turn out?
> D: The half [marathon] tomorrow? See, I – I'm probably, I'm think around 1:35 [hh:mm].
> Int: What's making you think 1:35?
> D: Well, it was 1:38 last year [referencing spreadsheet], it's a different course. I'm not as, motivated for it as I am Arbor City [another race in his log] which is coming up in 3-4 weeks. I'm more interested in racing the Arbor City half. I run this one because I like the course. I like it, I grew up here. But it's more, I put it on the schedule because it's a training run for the Dixie [another race]. So probably 1:35. That's what I think.

David felt comfortable making a forecast of his performance, in part by basing his estimates on his performance the previous year, his knowledge that the course was mapped differently this year, and his perceived interest. He also factored in his pace. In his race log, his pace (minute per mile) ranged from 7:08 to 8:31 across all of his races. For the current race year, his pace range tended to be between 6:42 and 7:45. As it turned out, David's prediction was fairly accurate. He finished the half marathon in 1:32 the following day.

Although the manner of logging for these two individuals differed, both Thomas and David were, like many others in our sample, habitual recorders of data. In the times that we spoke with them, they demonstrated how they each were able to inscribe different features of data and use them to make meaningful comparisons about themselves and reasonable forecasts for what they could accomplish.

Relationships with Data: Tensions and Realizations

In the examples discussed so far, there was a tendency to use data to aid in self-assessment. These individuals could comfortably use their data to situate their performance relative to the sporting season and to make predictions. However, technoathletes also used data to make judgments about their athleticism. In exploring these judgments further, we saw that for several individuals, this was also met with a tension between appreciation for and a general weariness with the data they collected. While valued, data were also seen as disruptive, as described by Tanner, a male cyclist in his 20s.

> T: When I started cycling earlier on…I thought "Oh, wouldn't that be cool to track my speed and know how fast I can go and track my miles," so I put a bike computer on both my bikes. I had it off within a week. I found that just having the numbers there, what I'd end up doing was just be like, looking at my computer more than paying attention to what I was doing. It wasn't a danger thing, I was still paying attention where I needed to, but I felt like it robbed my experience from everything around me. So, yeah, I don't like having numbers facing me or beeping at me during a ride.

Tanner was a bicycle enthusiast who was very knowledgeable about optimal bicycle components and loved the speed (especially downhill) he could reach while riding. But the data and their omnipresence were a distraction to him. As he described it, he felt that the technology "robbed" him of the experience. His solution was to stick his bike computer in a bag and bring it while riding. He was very interested in seeing some of the information, like his maximum speed, afterwards, but he did not want to see nor hear it while he was out enjoying his rides.

This was a sentiment expressed in a number of ways by others. Times and speeds quantified experiences and were used to compare with biking or running friends and thus establish status within their respective training or competition groups. These tendencies to consider status, however, detracted from a more visceral enjoyment that they also associated with their sports. Yet it is important to note that nearly all users of PAD devices also expressed some positive aspects of their data, even when it was presented in the midst of their activity. Stacy, a woman in her mid-30s who struggled with a family history of obesity, had a personal anecdote that illustrated how data layered into her exercise helped change her self-perceptions in a very affirming way.

> S: There was this hill and this incline, and I would always be so out of breath when I got to that, and I'd keep telling myself, "You're just being a wimp. You just need to buck up and do it." But every single time, I'd start up on it, and then I'd end up stopping and walking because it was so hard! And I just thought of myself as being a wimp…and just not being tough and getting out there and run, you know? And so I kinda had a low opinion of myself…And then when I got this heart rate monitor, and …I threw it on one day, and I was out running and all of a sudden, I get to that same point and… I was about to walk, and I did walk, and I glance down at my heart rate monitor and … my heart rate was 203! And I went "OH! A) I should be walking and B) I am not a wimp!" I need to, I need to walk through this. This is absolutely ridiculous to have it be that high…And all of a sudden, it was, "I'm not a wimp. I'm pretty tough if I can get it to that high."

As she described it, Stacy was very critical of herself and her ability because she evaluated herself based on whether or not she could maintain a speed and run up a hill. She identified with "being a wimp" and had a "low opinion" of herself. But after she got her heart rate monitor and checked the data it was producing during that incline, she realized that by the metrics it was providing, she was working very hard. In fact, she thought the heart rate value was too high, and she was able to reframe her need to walk from being the result of wimpiness to being the result of an accelerated and unsustainable heart rate. Interestingly, after she saw that information, her athletic identity went from being a "wimp" to being "pretty tough" based on the heart rate metric that was made visible with her PAD device.

Thus, physical activity data can also be a source of appreciation and positive identity development. These data can be used to form judgments about one's abilities, and that can be negative when that is not a desired focus during the activity. On the other hand, they can be a boon when an existing focus is causing distress. The data invite attention to certain features of a physical activity that are not made visible when doing the activity independent of any technology. As individuals who are interested in harnessing the technology to support learning, we believe that these and other anecdotes we heard from adult technoathletes ultimately highlight the importance of considering how learners might think about their own athleticism when they are given a chance to reflect on such personally-relevant information.

Summary and Instructional Implications

In this paper, we reported briefly how some technoathletes used PAD devices and the associated data that were produced. Logging practices were quite common among technoathletes, but there were still some individual nuances with respect to the media and forms in which data were represented and the ways in which those logging systems could be used. We also reported on how individuals felt, both positively and critically, about their activity data. The technologies they used were serving not only to create records, but also to make visible and prominent information about their experiences in ways that could be burdensome or redeeming.

As one of our goals has been to understand authentic physical activity data use to inform our research and design efforts, the cases and examples here give us some ideas for ways in which PAD technology might be used in designed learning environments. Technoathletes frequently reflect individual data over time and that longitudinal slice might be one important way for students to think about physical activity data. This suggests PAD use in classrooms might require extended engagement and a large amount of sampling so that such individual trends can be obtained and considered. In our previous work, we were actually far more conservative with respect to how much time we asked students to use PAD technologies and tended to encourage students to look at data gathered from multiple people rather than just themselves. It might be more appropriate to create situations in which individual students can passively acquire individual data over several weeks and then encourage or design activities that require students to examine how they feel the data reflect upon them.

Additionally, our conversations with technoathletes suggests that careful attention should be given to how data and technology can influence how individuals' views of themselves and their experiences. We often engage in physical activities for the sheer enjoyment of being active and being mobile in the physical world. It is possible that turning such activities into occasions of data reflection, a major goal in our work, can detract or affect the enjoyment that we experience when we simply focus on the positive experiences associated with mobility. On the flip side, it may also be possible we can help individuals who do not think they can enjoy and engage in such activities and give them a means to understand and appreciate what they are capable of doing and experiencing. We look forward to exploring these issues more in the future.

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Acknowledgments

All participants are listed with pseudonyms. This work was supported in part by NSF grant no DRL-1054280. The opinions in this paper are those of the authors and not necessarily of the US National Science Foundation. Ani Aghababyan and Michelle Berry kindly assisted with collection and preparation of these interviews.