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Experts Note

Wearable Technology in sport, a convergence of trends

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Biography

Daniel James, directs SABEL Labs a distributed research and consulting enterprise based in Australia. He has been working with technology ever since he discovered he had opposable thumbs and today applies many disciplines of the sciences to understanding human movement for health and sporting applications. His research has led to competitive athlete success, improved health outcomes and several commercial products. He holds a PhD in Physics and post graduate degree in Business.

INTRODUCTION

Wearable technology offers the opportunity for information and life to seamlessly integrate through the measurement of the bodies' physiology and biomechanics. Although the technologies are still in their infancy they are today fashionable, topical and experiencing tremendous growth. To date they have found widespread utility in sporting endeavours and more recently have been applied by consumers and researchers alike to health contexts as one of the most popular smart devices. Michael Porter, well known business strategist recently took a look at 'Smart Devices' [1] describing it as the third wave of IT that will likely transform many industries.

These small technologies are a relatively new influence on sport and healthy activities. Where once technology was constrained to building better bikes, today technologies like wearables have become a favoured tool for improve athlete performance and reduce injury [2-3]. Athletes are, some would say, the formula one equivalent of testing these technologies ready for mass-market consumption. Thus the gradual transference of laboratory-based technologies and sensors [4] for medical applications and sport has found its way onto the playing field [5], swimming pool [6] and eventually that has trickled down to consumer lifestyle devices. This began with heart rate sensors and now activity based monitors like Fitbit are popular. At the time of writing the wearables market is the number one consumer fitness product [7] and is worth $USD14B [8] and has been growing at around 12-25%pa for the last 5 years or so depending on who you ask [5].

TRENDS

Why are lifestyle wearables emerging and doing so well? Partly it's the trickle-down effect from elite sport. However it would seem they are, in part the product of several global trends and finding themselves at a sweet spot of their intersection. Some of these major trends are miniaturisation, technology convergence, appetite for data and the global rise of the leisure class, which all play an important role.

MINITURISATION

Some of the key drivers for wearables is the steady miniaturisation of sensors, these follow the widely held maxim of Moore's law [9] originally designed for increasing transistor density, it has today found utility in predicting, that for any given complexity, the size of a technology will halve approximately every 1.5 years. A

primary technology inside many is the accelerometer which first saw itself used as crash detectors in cars [10], then was further miniturised when included into smart phones [11] as an input device for orientation. These two huge industries thus have driven the development a low cost sensor that consumers mere micro amps and lend themselves well for use in body worn devices, with some products lasting up to a year without a recharge.

CONVERGENCE

Today the fundamental ingredients of many consumer electronics products are, under the hood, fundamentally similar. This brings with it the benefits of economies of scale, and that product customisation is something the end user does, or happens at the very final stages of product refinement. It also means products in one market can become products in another market quite easily. A good example of this is the mobile phone, where Nokia for a short time, became the world's largest camera manufacturer (after converging with digital cameras). Further afield KPMG examined key consumer technologies many of which are converging and estimates are in the next four years an almost tenfold use in them and corresponding use of data [12].

DATA

With the convergence of technologies, and many of them digital, there is a corresponding increase in data appetite. Technologies are producing, storing, transmitting, interpreting and retrieving data, for an increasingly data hungry consumers. This was once a cumbersome task but is now increasingly ubiquitous with easy access to the internet and seamless integration giving rise to the internet of things. A good example of this is the rise in of smart phones, over their more traditional counterpart [13].

RISE OF THE MIDDLE AND LEISURE CLASS

Wearables for consumers represent an attractive purchase that has function, yet is fashionable, offering an essentially disposable want for often less than $US100, it makes a good gift [14]. CSIRO reports a number of formerly developing nations, with large populations, are now aspiring and becoming middle class affluent [15]. The new entrants signal a growing new market alongside existing first world nations. The prognosis is good for consumer and consumable electronics industries, with potential customers having plenty of time for leisure on their hands.

MARKETPLACE MOVEMENTS

Today the size of the market has grown significantly, so much so that the 'big boys' have gotten themselves involved. First to come were the sport brands like Nike with the 'fuel' band and Garmin with the shrinking wrist-worn GPS for sports people (battery life is still a challenge though). It was an attractive proposition for these brands as it aligned well with their core business, where Nike was one of the first to introduce a wrist worn technology, and the original Fitbit originally being body worn in the belt region.

As the market steadily grew came the computer brands, in particular the smart phone manufacturers such as Apple, Samsung and Microsoft joined the dedicated wearable products [16]. One driver was that smart phone sales were beginning to slow. At first glance the size of smart phones had bucked the trends of Moore's law (that of miniaturisation), probably because they are more convergence devices than phones (that a smart phone encompasses a computer, phone, video phone, mobile computer), thus the smart watch was a natural size evolution to follow Moore's law.

With the emergence of the devices on the wrist it also attracted a market that had long been commoditised and in decline, that of the wrist watch [17]. Here anecdotally with profit margins existing only at the luxury end, smart devices represent a chance to recapture that.

CONCLUSIONS

An interesting consequence of creating a large consumer market is that it now starts to then trickle back up to elite sports and research. The price point and ease of use makes them very convenient for sports science and more recently clinical applications. Of course a consumer product is never designed to rival a scientific product like an Actigraph™ or the traditional ambulatory Holter ECG monitor, but it is a whole lot cheaper and likely to be more user friendly as well. And so perhaps by accident Fitbit began to penetrate, may disrupt, these traditional areas [18]. Some negative consequences then started appearing through negative validation studies in the scientific literature [19], and the perhaps unintended use as a medical device has resulted in a class action lawsuit on inaccurate heart rate data, which is still playing out [20].

Wearables offer an exciting and unparalleled opportunity for human centred research. As the consumer market matures, it will become easier than ever for researcher to have access to progressively higher quality low cost instruments. Convenient, low cost ambulatory monitoring of human subjects offers the excitement of collecting data not being able to be collected before, and is a vehicle to answering new and interesting research questions. So for health applications where lifestyle assessment of cohorts is now achievable at low cost. However, probably the most exciting opportunity is the ability to scale up research from individual case studies to respectable sized cohort to large-scale populations over greater timeframes. Together with the coming of the Internet of Things (IoT) there will be increasing amounts of data available, with which to integrate [21] and from divergent data sources comes data fusion [22] with new insights to how we live, work and play sport.

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