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Classification of data and activities in self-quantification systems

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SUMMARY

Self-quantification may be seen as an emerging paradigm for health data. In recent years the general public has become more health-conscious, due in part to the self-tracking and quantification technologies that enable the non-expert to easily capture and share significant health-related information on a daily basis (Mehta, 2011). This self-tracking of personal health and fitness data has the potential to introduce new research methods in citizen science, and in formal research into personalised medicine and healthcare (Swan, 2009). Such methods capture data in real tasks, natural settings, and in situ, as well as facilitate the measurement of some health and life aspects longitudinally, with an aim of generating healthcare-related hypotheses. However, this field lacks a systematic approach to classifying these data, and making sense of these observational measurements. This paper reports on our data classification model, and how it can be used in data collection, data analysis, data curation and data exchange.

INTRODUCTION

Self-quantification contributes significantly to the health big data phenomenon. Self-quantification is the use of multiple self-tracking devices by individuals and populations, and it may generate and aggregate physiological, environmental and genetic data on a grand scale. 69% of U.S. adults keep track of at least one health aspect such as weight, diet, exercise routine, or symptom (Fox, & Duggan, 2013). Smartphone-based fitness and mHealth (mobile health) devices users may globally approach 100 million by 2018, up from 15 million in 2013 (Juniper Research, 2013). Thus, self-quantification can generate data that are big in themselves. Furthermore, people with more serious health concerns are more likely to track multiple health aspects, which consequently could produce huger volumes and a broad range of data types.

Some self-trackers are concerned with helping themselves, and they tend to test random ideas which are not medically proven to be associated, however others are interested to share and compare their data. The intersection between self-quantification and big data poses major challenges in making sense of these data in shared settings, such as support groups, or health research. One challenge is providing a unified language for the measurements that are being made. Over the last few years, we can find much work being done on data classification from the description of health-related states (such as in WHO-ICF), the prescription of mobile health apps (e.g. Happtique), or the function of the health apps (e.g. European Directory of Health Apps). However, we have not seen a data classification that is designed to support aggregation of data generated from personal self-quantification. As yet the field of self-quantification lacks a formal architecture for data and measurements, which could contribute to new discoveries and improved health outcomes.

DESCRIPTION

We propose a classification model called Classification of Data and Activities in Self-Quantification Systems (CDA-SQS), see Figure 1. This model is adapted from the International Classification of Functioning, Disability and Health (ICF) that has been developed by the World Health Organization (WHO).

Our data classification model is designed with consideration to the following general principles:

- Health and wellness as the basic organising concept.
- Fit within a comprehensive framework for describing self-tracking practices (e.g. tools and technologies, data and measurements, time and location, etc.).
- Reference to pre-existing classification systems developed to account for conventional and unconventional observations of potential influences on a health condition.

The proposed classification model consists of three domains (Figure 1). Each domain has several categories as follows:

1. Body structures and functions domain which includes: mental functions, sensory functions, sensation of pain, voice and speech functions, cardiovascular system, haematological system, immunological system, respiratory system, digestive system, metabolic system, endocrine system, genitourinary functions, reproductive functions, skeletal system, muscular system, nervous system, skin, hair, nails, genome (DNA, RNA and genes), and microbes categories.
2. Body actions and activities domain which includes: learning and applying knowledge, communication, mobility, self-care, domestic life, interpersonal interactions, education, work and employment, economic life, recreation and leisure, and religion and spirituality categories.
3. Around body domain which includes: relationships and attitudes, products or substances for personal consumption, products and technology for use, and natural environment and human-made changes to environment categories.

This classification model describes these domains as interactive and dynamic rather than linear or static. It is applicable to all people, whatever their health condition. It is also relevant to all self-tracking and quantification practice and technologies identified in the authors' prior review (Almalki, Martin-Sanchez, & Gray, 2013).

Our data classification model can be used for describing the vast array of measurements generated in self-tracking. If we think of self-quantification as a way of investigating factors which affect health and fitness, we can see that we need to describe three main components as illustrated in Figure 2. The component number one provides the investigation questions or hypothesises. The second component sets the main attributes of a particular study, the study's sample, the assays, and describes the instruments used in the study. Such instruments are classified into two categories: primary and secondary self-quantification systems (SQS). This SQS taxonomy is explained in detail in Almalki, Martin-Sanchez, and Gary (2013). Also, the second component explains the measurements – this is where our model provides a way to classify such data and their types. The third component is the data generated from the investigation.

CONCLUSION

Self-quantification produces big data, and has the potential to advance healthcare knowledge. However, it lacks a formal architecture for describing the data that are generated. Our CDA-SQS model for classifying such data overcomes this problem and enables more systematic research in this field.

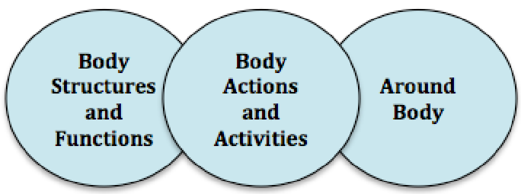

Figure 1. The proposed CDA -SQS model

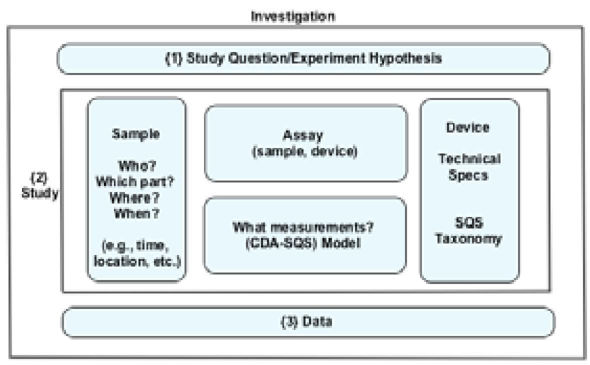

Figure 2. Self-quantification investigation components. {Numbers are used for illustration only}.

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