

Personal Reflection Alongside Anonymous Aggregate Data

Introduction

Research on reflection and personal informatics describes the role that purposeful review of one's data has on gaining personal insights [1,2]. Increasingly, research on reflection has noted the opportunities presented when data review is designed as a social process [3]. Many systems have explored how social interaction (e.g., social support [4] or competition [5]) can be incorporated into the design of systems to promote behavior change. By introducing the data of others, however, you are not only enabling different types of insights [6], but also introducing new privacy concerns [7].

One way to respect the sensitivity of shared personal data, while still encouraging interaction with data from others, is to aggregate and anonymize data. This process of presenting aggregate data separated by demographic groupings has already been incorporated into many modern commercial systems, such as Fitbit [8] and Strava [9], which allow you to compare your personal data to others of the same gender. Little work, however, has been done to explore how anonymous aggregate data could be incorporated alongside personal data to enable new kinds of insights during reflection on that data.

To address this gap in the research, we used physical, social, and psychological health data collected from 47 students over two weeks. We recruited 10 of these students to participate in a data review session where they were given the opportunity to interact with their personal data alongside the data of cohorts constructed from the 47 students. Through this study we uncovered a number of unique ways that anonymous aggregate data impact the reflecting process. We report on how individuals formed bonds with cohorts in the absence of traditional pre-existing social ties, how cohort data was used to determine what "normal" behavior was, and what this means for the construction of personal health goals. These insights suggest exciting new directions---and specific design concerns---for future personal informatics systems.

Our Work

Using personal health data capturing *daily physical activity*, *digital social activity*, and *stress* collected from 47 undergraduate and graduate students, we constructed 15 cohorts using demographic (i.e., age and gender) and psychographic (i.e., resilience and perceived stress). Ten participants from this collection effort participated in a review session in which their data was presented alongside the same types of data of the 15 cohorts. In a think-aloud semi-structured interview, participants were asked to 1) investigate any interesting phenomena in their data, and 2) set and specify a goal for the near-term using the data [10]. Participants were free to add or remove cohort data as they saw appropriate for the task (e.g., an individual could show or hide a variety of types of cohort data from the interface and choose to use only their personal data in goal setting, or select others' data to view alongside it). From this study we uncovered seven themes related to how individuals interact with their data when provided access to anonymous aggregate cohort data.

One critical finding from our study is how individuals "formed relationships" with anonymous cohorts. Initially, participants looked for cohort data that indicated shared personal or lifestyle characteristics (e.g., age as a proxy for specific student status). A participant's relationship with a cohort was not static, however, but was modulated by how similar their data *appeared, graphically*, to another cohort. Participants would actively seek cohorts with trends in data similar to their own. If a cohort

differed significantly across the three data types (daily physical activity, digital social activity, and stress), this could weaken their association with the cohort, even if the cohort was initially seen as sharing personal characteristics. Equally, participants would identify with, and utilize more throughout the study, those cohorts that consistently showed graphical trends similar to their own data.

After participants had decided what cohorts to include in the review of the personal data, cohort data played a significant role in how individuals set goals. Participants would use an approximated average of all the data from selected cohorts to determine what data was "normal." The participants then used this notion of what data was normal, in combination with their own data, to construct their personal goal. Goals were, therefore, a product of their own data, as well as the data from cohorts. In fact, VERA, a system that offered open-ended awareness of others' data saw a similar behavior of participants constructing personal notions of acceptable health behavior [6].

Discussion

These findings indicate unique design considerations for systems that want to incorporate anonymous aggregate data and new avenues of research for work in personal informatics and reflection.

The preference of individuals to use cohorts that share similar graphical representations means that reflective systems may, intentionally or not, encourage users to identify with groups this way. If the represented behavior is not necessarily "healthy" (e.g., consistently sedentary behavior), individuals may select cohorts with similar data reflecting a sedentary norm. This has the potential to create a shared norm that could encourage goals that are not based on credible guidelines. At the workshop, we look forward to discussing how to cultivate a fuller understanding of how the representation of cohort data could affect behavior, and what open research questions result from our study. For example: how do individuals evaluate similarity in presentation methods beyond our chosen representation (a line graph)? What characteristics of the visualization determine similarity? Should a system dynamically change the way the UI represents cohorts, to encourage users to select certain cohorts when constructing their goal?

If we consider how personal informatics applications can be used to help individuals better understand their behavior, rather than a means of directing behavior, we see new opportunities for research. In our study, participants were extremely inquisitive about the data. Not only did participants want to find patterns in their own data, but also in the data of others. Baumer offers *inquiry* as a dimension of reflection[11], and by providing access to 15 cohorts to each individual in our study, we introduced additional opportunities for inquiry that would not be possible through personal data review alone. At the workshop, we look forward to discussing the benefits and downsides of making these data available. Access to so many sources of cohort data allowed individuals to support the dynamic nature of their relationships with the cohorts. However, introducing all these new streams of data has the potential to overwhelm users. How do we think about fostering meaningful interactions with personal data through the additional use of cohort data?

The study we present here is an introductory exploration of how anonymous aggregate data impacted personal reflection. At the workshop, we look forward to extending the ideas discussed here to explore opportunities to study them further and develop a deeper understanding of the implications for collective informatics, including how to incorporate the data of others to support different types of reflection.

References

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