

Technology and Motivation to Exercise: Data Display Formats

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ABSTRACT

The purpose of this study, inspired by observations of the increased use of data-driven fitness activity trackers, is to measure how using different methods to display the same set of data influences perception of its value: understanding of the data, informative value of the display, and motivation to take action or change behavior. Previous research predominantly focuses on the effectiveness of wearables, not their displays. For this study, data was collected from 273 respondents: approximately equal males and females ranging in age from 18 to 72 (average age of 31) from OSU undergraduates and Amazon's Mechanical Turk. Participants evaluated different charts, tables, and graphs created from identical data: 2 line graphs, 2 bar graphs, 1 pie chart, 1 table, 1 radar graph, and 3 visual displays. Questions assessed interpretation and understanding of the material as well as personal perception of the informational and motivational value of the displays. Respondents ranked motivational power of the displays in the following order (most to least): visual display, table, pie chart, line graph. Average BMI of the participants was 26.84, with a max of 49.59 and min of 17.16. Consideration of Future Consequences and Need for Cognition were also included. The results can be applied to the health and medical fields by providing insights into data display formats that are more likely to promote healthy diets, exercise, and/or maximize medical prescription adherence.

INTRODUCTION

- Since 1950, sedentary jobs increased 83% and less than 20% of jobs are considered physically active
- Wearables are expected to grow at a compound annual rate of 35% over the next 5 years from 2015
- Fitness bands and other miscellaneous devices account for 36% of the wearable device market with 33 million units shipped in 2015
- Internet-driven fitness activity trackers, such as the Fitbit, display progress more visually and offer significant advantages over traditional devices such as pedometers

Figure 1: Data displays used on fitness activity trackers



Different ways in which progress data is displayed on fitness activity trackers and their apps; the graphics shown here are pulled from the dashboards of the Fitbit Force, Fitbit Charge, and Apple smartwatch.

METHODS

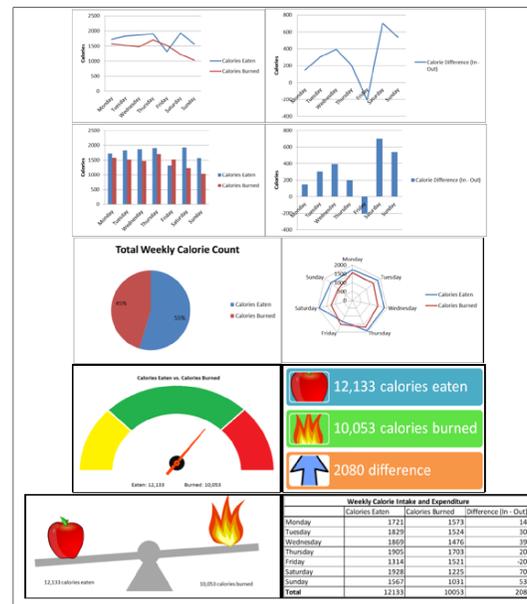
81 Question Survey

- Qualtrics survey software
- 10 different data displays; 1 data set
- 273 respondents
- OSU undergraduates and Amazon's Mechanical Turk (paid)
- Mixture of timed accuracy tests, perception of informative and motivational value, and preference
- Includes Need for Cognition scale and Consideration of Future Consequences scale

Sample Questions

- "Based on the data from the previous graph, which day of the week was the amount of calories burned more than the amount of calories eaten?"
- "Please rate the 3 displays based on their ability to motivate you to eat healthier or exercise more, from 0 (not at all motivating) to 10 (very motivating)"
- "Which graphic do you prefer as a progress tracker?"
- "I find satisfaction in deliberating hard and for long hours"
- "When I make a decision, I think about how it might affect me in the future"

Figure 2: Data displays used in the survey



Data displays used in the survey, from top to bottom (all showing calorie intake vs expenditure): line graphs, bar graphs, pie chart and radar graph, visual display (speedometer) and visual display (list), visual display (seesaw) and table.

RESULTS

Figure 3: Perceived consistency in balancing calories

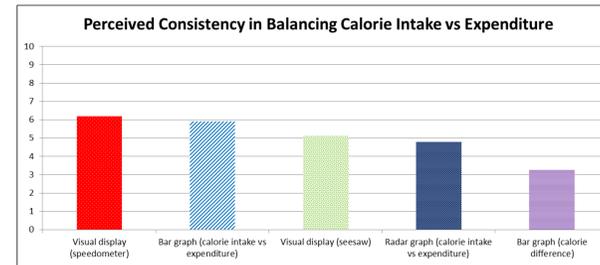


Figure 4: Perceived importance of display characteristics

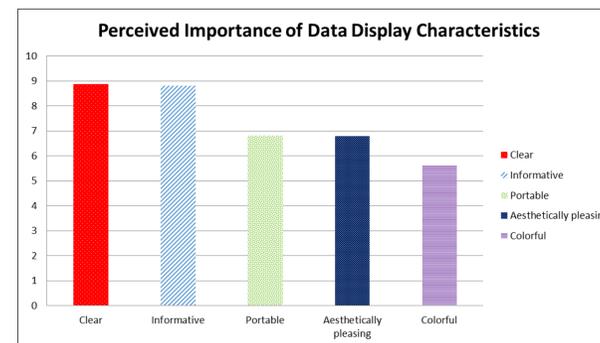


Figure 5: Accuracy rate by Need for Cognition

	Need for Cognition (Bottom 25%)		Need for Cognition (Top 25%)	
	Line graph	Table	Line graph	Table
Count of accurate	29	42	36	49
Count of inaccurate	27	14	20	7
Average time spent (in seconds)	106.89	45.01	49.67	27.34
Total count of responses	56	56	56	56
% Accurate responses	52%	75%	64%	88%
Average Need for Cognition	44.73		78.25	
Min Need for Cognition	18		72	
Max Need for Cognition	54		90	

Figure 6: Perceived level of motivational power

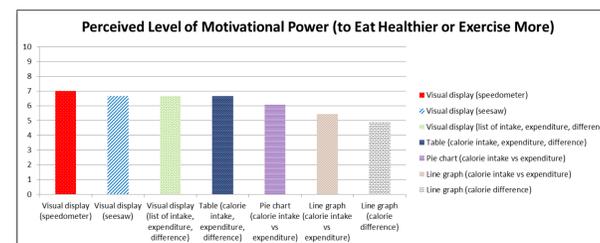
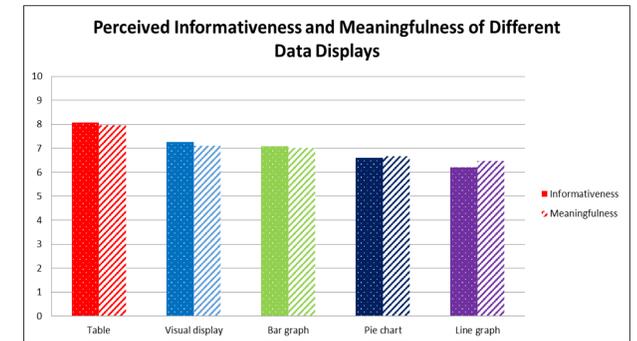


Figure 7: Average rating of different data displays



CONCLUSIONS

- A table is the most informative and meaningful data display format; respondents who ranked in the bottom 25% in Need for Cognition and those who ranked in the top 25% both found the table easier to understand (they took less time to view the table yet answered more accurately) than the line graph
- How data is displayed influences the severity of conclusions people deduce from data, even when the data itself is unchanged (the same data set is used to create every display)
- Respondents prefer clarity and informative value over portability and appearance-related characteristics
- Respondents perceived the visual data displays as showing more consistency in calorie intake vs expenditure, yet consider them to have more motivational power in getting them to eat healthier or exercise more
- Line graphs are perceived as the least informative and meaningful type of display, as well as the least motivating

BIBLIOGRAPHY

1. Diaz, K. M., Krupka, D. J., Chang, M. J., Peacock, J., Yao, M., Goldsmith, J., Schwartz, J. E., Davidson, K. W. (April 15, 2015). Fitbit®: An accurate and reliable device for wireless physical activity tracking. *International Journal of Cardiology*, 185.
2. The Price of Inactivity. (2015, July 31). Retrieved from http://www.heart.org/HEARTORG/GettingHealthy/PhysicalActivity/FitnessBasics/The-Price-of-Inactivity_UCM_307974_Article.jsp.
3. Tully, M. A., McBride, C., Heron, L., Allen, W., & Hunter, R. F. (2014). The validation of Fitbit Zip™ physical activity monitor as a measure of free-living physical activity. *BMC*.
4. The Wearables Report: Growth trends, consumer attitudes, and why smartwatches will dominate. (2015, May 21). Retrieved from <http://www.businessinsider.com/the-wearable-computing-market-report-2014-10>.

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