

uc_Eating:

Ontology for unambiguous characterization of eating and food habits

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***Abstract*— The *uc_Eating* ontology seeks to create a standardized unambiguous characterization system for modeling human food habits and eating processes. The creation of a computational knowledge base allows for the assessment, identification and characterization of eating patterns. Enabling individuals to use the model across multiple scenarios. Simultaneously, these ontologies provide an infrastructure for annotating the relationships between food consumption and eating behaviors creating a foundation for the characterization of human eating processes.**

Introduction

1.1 billion adults worldwide are considered overweight and 312 million are medically diagnosed as obese [1]. Obesity, a growing epidemic is becoming the largest public health obstacle in the world. While food no longer only encompasses a means for fuel it also contributes to improve performance amongst an array of activities. Individuals who consume multiple small meals a day compared to infrequent large meals happen to promote an increased energy intake allowing for the utilization of foods in sports or other physical activities [2]. Aside from the frequency and timing of food consumed many cultural factors concomitantly transpire. Food choice is a key component in health and eating behaviors are acquired over a lifetime from various influences [3]. Food consumption practices allow for the sharing of culture that brings people together. However, in the last decade American adult participation in social media climbed from seven to sixty five percent of the population [4]. Therefore, altering the food habits and consumption patterns of users. Yet, while modern science clearly demonstrates alterations in human eating behaviors and patterns contribute to disease progression, to date they have received very limited attention in the world of ontological research. Recognizing the importance that eating behaviors and patterns play in both disease progression and health improvement. This ontology seeks to create a standardized unambiguous characterization system for modeling human food habits and eating processes. The different behaviors of eating are identified to help establish a conceptual model for better understanding how these processes interact. Hierarchies are utilized in order to show the

detailed relationships between entities within each process demonstrated in Figure 1. The characterization for human eating patterns allow for multiple uses such as Google’s micro-moments, which characterize specific in-the-moment occurrences that can elicit different responses [5]. It is important to classify diverse micro-moments to characterize the resulting eating behaviors. Other uses include, creating inference patterns to personalize health condition assessments such as obesity [6]. According to the eating pattern ontology developed by Sojic et al. “an eating pattern ontology can create personalized profiles across several obesity-related knowledge-domains structured into dedicated modules in order to support inference about health condition, physical features, behavioral habits associated with a person, and relevant changes over time” [6]. Thus, providing the implications necessary to build a useful ontology. Within the National Center for Biomedical Ontology, classifications of eating behaviors exist within a very limited range of specifications. For example, the Gene Ontology characterizes eating behavior as the “reduction of food intake in response to dietary excess” providing little regard to the actual processes that coincides [7]. Our goal is to create a further specified interpretation of those eating behaviors.

I. DESIGN AND METHODS

Open world assumptions of semantic web ontology languages (OWL) provide a means for capturing the diverse array of behaviors and concomitant responses. Simultaneously, ontologies provide an infrastructure for annotating the relationships between food consumption and eating behaviors, providing a foundation for the characterization of human eating processes. The use of the program Protégé, provides necessary tools in order to create and characterize a useable ontology. In doing so, a myriad of specific behaviors are classified within each co-occurrent processes that interconnect demonstrated in Figure 2. All of which contain several subclasses used to identify multiple areas of the hierarchy. To begin, identification of base classes consisting of different biological behaviors conspired. The differentiation of behaviors and processes stayed crucial in the comparison of how individuals behave amongst various scenarios. It is

important to create an understanding between the different behaviors and processes that occur. Behaviors may be seen as occurrences that are self-induced whereas processes are incidents that can be out of the individuals' control. The base class "meal eating behavior" characterizes numerous types of meals that are consumed by individuals including, celebratory meal, post-workout meal, feasting meal, religious meal, and holiday meal behaviors. Identified in Figure 2, various processes and behaviors of eating patterns allow for the construction of a concise functioning model. Part of human nature involves the ability to make decisions on what to eat based on the environmental and social influences. Compensatory meal behaviors involve food consumed to compensate for sleep, stress, physical activity and for other foods consumed. Characterizing environmental influences, as entities help create a full understanding of one's eating patterns. Other sub classes include "snacking behavior, regulated eating behavior, eating behavior concomitant with other behaviors and eating influenced by external and internal stimuli". The entity "eating concomitant with other behavior" exhibits various activities that one can engage in whilst eating such as eating while laughing, exercising, reading, crying, talking and etc. The base class "snacking behavior" consists of different timed snacks that take place comprising of, after school, late-night, mid-day, and morning snacking behaviors. Assessing various behaviors such as snacking allows for the determination and specific identification of eating patterns that occur. Regulatory eating behaviors are included to help the understanding why people consume various types of foods. Determining behaviors based on regulation allows for concisely identifying every aspect of the patterns of eating. The base class of "regulated eating" comprises of subclasses identified as ethically regulated eating behavior, health oriented eating behavior, hunger oriented eating behavior, and religious regulated eating behavior. It is crucial to look at these subclasses individually and as a whole entity to correctly and specifically categorize the eating patterns of individuals. Each behavior remains perceived as a single fixed occurrent or regarded as co-occurents. Multiple entities interact with each other such as micro-moments, concomitant eating behaviors and eating influenced by internal stimuli. Micro-moments remain characterized by specific in-the-moment occurrences that can elicit diverse responses. It is important to classify different micro-moments to characterize the resulting eating behaviors. In relation to eating, people make decisions of what to eat, when to eat, and where to eat based on micro-moments. The class of "eating influenced by external stimuli" also connects to the micro-moments where all aspects of the environment, media and culture come into play. Although occurrences are occasionally recognized individually, the ontology helps create a clear and concise model for identification of behaviors amongst individuals. Deciding which foods to consume vary by individual contingent on countless attributes, recognized by the uc_Eating ontology.

II. CONCLUSION

The consumption of food is studied vastly amongst anthropologists, biologists and various scientists. Determining influential attributes that affect eating patterns is a key component to better understand physical health and help disease progression. Consumption of various foods constitutes a large role in the health of individuals and influences longevity. The identification for the consumption of various meals assessed by Glanz et. al states, "Value times expectancy' affects the decision to act" [8]. Identification, characterization and assessment help create an accurate representation of various eating patterns consumed. Decisions on food consumption are dependent on the value of reward and expected results due to the consumption. It is vital that connections between eating processes present the interplay between all of the necessary characterizations. Multiple processes that affect the consumption of food are characterized to ensure that almost all areas of what constitutes eating are classified. The consumption of food contains an array of influences that affect which eating processes take place. The unambiguous characterizations of these processes that occur create a useful tool that can be applied across multiple scenarios.

Figure 1

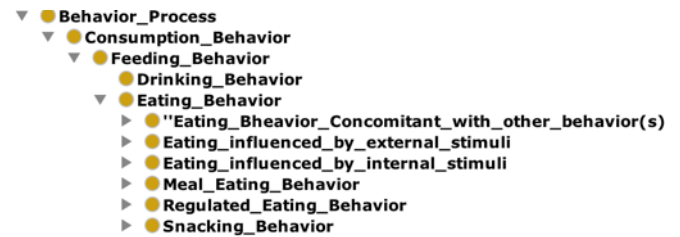


Figure 2



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