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GAME THEORY TO IMPROVE SECURITY

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This presentation addresses the issue of computer security and explores the use of game theory as one solution to improve it. Game theory has advantages over other solutions in that the game designer models the problem and evaluation criteria, and players' moves optimize the environment once the game is set into motion, reaching an equilibrium solution. Furthermore, game theory allows for modeling complex problems that would be more difficult using other approaches.

SYNTACTIC AND GRAMMATICAL STRUCTURE IN THE CHATTER OF THE EUROPEAN STARLING, STURNUS VULGARIS

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Introduction: The European Starling, *Sturnus vulgaris*, is a very social and vocal avian species common in the United States. Its vocalizations can be divided into two distinct categories – song and chatter. Song is non-directed, and although structured, is not language-like. Chatter, on the other hand, is structured and largely directed to other conspecifics. Numerous researchers have analyzed starling song structure. However, the chatter has received little attention. Starling chatter has a distinctive staccato-like chirp and cannot clearly be followed by humans until it is slowed by a factor of four. In its slowed form, structure in the chatter becomes evident. In this study over one thousand chatter motifs were analyzed for syntactic and grammatical structure. Comparisons to both human language and dolphin whistles were made using the methods of McCowan et al. (1999).

Methods: Chatter samples were collected over a four-year period from 2011 to 2014 from an urban nesting site in Broken Arrow, Oklahoma. Discrete chatter samples were extracted from the larger audio files. Custom software, "YakTalk", was developed to extract, enhance, organize and analyze the samples. Over 1,000 chatter samples were extracted and analyzed.

Results: Starling chatter shows a high-level of structure as demonstrated by syllable frequency counts, the Zipf statistic and a recursive grammatical structure. Over 50 syllables were identified. Syllables used for the statistical analysis were "simple" syllables with relatively few frequency shifts. Other syllables dubbed "hyper-syllables" consisted of vocalizations with 90+ bps frequency changes. These were largely excluded from this study, as the software was not designed to match on such complex utterances. Generation of a grammar for the chatter motifs revealed recursion, a feature thought only present in human languages (Hauser, Chomsky and Fitch 2002).

Conclusion: Starling chatter is very language-like statistically and in audible perception. With its similar Zipf statistic, starling chatter entropy is largely indistinguishable from human language and dolphin whistles. Considering the discovery of recursion in the chatter grammar, it becomes tempting to call it a language. The meanings of the utterances are unknown, so more

work needs to be done. The hyper syllables potentially contain a large amount of tightly packed encoded information, so the software needs modifications to parse them. Recursion in the grammar needs a more in-depth look with analysis of longer motifs and at least double the number of chatter samples to resolve higher entropy orders.

SNOOPY: PORTABLE SOFTWARE FOR CAPTURE-RECAPTURE SURVEYS

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Introduction: Camera trapping capture-recapture surveys have become a very important data gathering technique in recent years. Data collected from these surveys is important in animal species abundance, distribution, richness and behavioral studies. As these surveys often produce large amounts of media captures, software to catalog and organize the media has become increasingly important. The available software is limited. The goal of this project was to design and build a comprehensive and portable software suite for capture-recapture surveys.

Methods: The initial stage of the project was requirements gathering and identification of features in currently available software. Software architecture was modeled in Paradigm, a UML modeling package. The software was coded in the Java language on top of an ODBC (Open Database Connectivity) backend using MySQL for the database. This architecture ensured portability to Windows, Mac X and Unix platforms. Comparisons were made continuously to the existing software project, CameraBase, to include desired features and modify others for improved flexibility.

Results: The completed software includes desired features identified from existing software packages as well as advanced features such as environmental and weather-related data. The software was architected to include media recorders other than photographic including audio and video, as well as the ability to add environmental recorders.

Conclusion: Snoopy is a capture-recapture study platform that can be built upon for future enhancements as well as a comprehensive tool for existing surveys. The software is portable to the common operating system platforms and includes a highly configurable database backend. Data can be stored in any ODBC-compliant database of the user's choice including MySQL, MS Access and SQL Server. The user-interface in Snoopy is object-oriented, context-sensitive and intuitive. Future enhancements planned include image recognition and GIS data.

NAÏVE NARCISSISTS OR AFFABLE ALTRUISTS? PERSONALITY CHARACTERISTICS OF THE MILLENNIAL GENERATION

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Millennials, those born between 1982 and 2002, are typically portrayed as tech-savvy narcissists who crave constant feedback and attention (Chambers, 2010; Deal, Altmann & Rogelberg, 2010; Twenge 2011). The current study examined whether these characteristics are really more representative of Millenials than individuals from another generation. Thus far, research on Millenials has predominantly relied on data gathered from college student samples (Deal et al., 2010; Twenge, 2013). Thus, some researchers have suggested that differences in characteristics of Millenials and members of other generations may be a function of different levels of maturation or reliance on non-representative, student-based samples rather than real differences

in personality between members of different generations. This study used archival data gathered from young, working American adults between the ages of 23 and 29 to compare personality characteristics of members of Generation X (those born between 1962 and 1983) to characteristics of members of the Millenial generation. The archival data set included responses from approximately 26,000 Millennials and 9,000 members of Generation X on Hogan Assessment Systems Motives, Values, and Preferences Inventory (MVPI). Based on characteristic typically ascribed to Millenials, five of the 10 MVPI personality factors were compared: recognition, hedonism, altruism, security and affiliation. Significant differences between the generations were noted on hedonism, altruism and affiliation with Millenials scoring slightly but significantly higher than members of Generation X on those three personality characteristics. Thus, Millenials may have higher leisure preferences than members of Generation X, but they also are likely to be more giving and sociable the Gen Xers. Because the current study is based on archival data, causal conclusions are not warranted. Additionally, because the data was collected over several decades, the differences noted between respondents from different generations may be reflective of subtle response biases due to changes in societal values rather than real interpersonal differences.

CULTIVATION STUDIES ON THE GASTROINTESTINAL TRACT FROM AN INDIGENOUS PERUVIAN COMMUNITY YIELDS SEVERAL NOVEL BACTERIAL TAXA

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While the literature contains many examples of studies focused on the human gut microbiome of individuals from western populations, indigenous populations with a "non-western" diet and lifestyles are underrepresented. In order to truly determine if there is a core human microbiome, individuals with a variety of diets and geographic regions also need to be included in these investigations. The primary purpose of this study is to test the hypothesis that traditional communities from remote regions harbor novel microorganisms influenced by diet, health, and environmental conditions. We used rRNA-based road maps generated in our laboratories to target previously uncultivated bacterial groups to investigate their phylogenetic, physiological, biochemical, and chemotaxonomic properties. Freshly voided fecal samples were collected from members of the Afro-Peruvian community of Cruz Verde in Tambo de Mora, region Ica, in Peru. Multiple enrichments using an array of substrates were constructed and inoculated with 1 ml of fecal slurry. All isolates recovered from the enrichments were maintained on blood agar plates and were screened using 16s gene sequence analysis. A number of isolates yielded relatively low sequence similarity values to those in DNA databases; phylogenetic tree topologies demonstrated that a number of isolates belonged to a group of organisms known as the anaerobic Gram-positive cocci. The nearest relatives included members of the genera Peptoniphilus, Finegoldia, Gallicola and Parvimonas. To date, our studies have identified two novel genera and a new species belonging to the genus Peptoniphilus recovered from a single individual. Our investigations demonstrate that remote indigenous communities harbor novel microbial taxa and further studies employing culture-based approaches of human gut microbiomes of diverse communities are encouraged to augment the insights provided by molecular investigations. Cultivation and characterization of novel organisms from these unique communities will help to

gain a deeper understanding of ecological and functional diversity of the gastrointestinal tract of indigenous communities.