Towards the Gamification of Well-being Measures

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Abstract— There is an overriding interest in measuring the well-being of communities and institutions: healthy (flourishing) individuals and groups perform "better" than those that are not. Capturing the facets of well-being is, however, not straightforward: it contains personal information with sometimes uncomfortable self-realizations associated to it. Yet, the benefit of such data is the ability to observe and react to imbalances of a community, i.e. it can facilitate community management. Due to its personal nature, the observation of well-being needs to leverage carefully considered constructs. To have a comprehensive look at the concept of individual well-being, we propose a gamified frame of reference within a social network platform to lower traditional entrance barriers for data collection and encourage continued usage. In our setting, participants can record aspects of their well-being as a part of their "normal" social network activities, as well as view trends of themselves and their community. To evaluate the feasibility of our approach, we present the results of an initial study conducted via Facebook.

Keywords- *Digital relationships, Social network propagation, Social networking design, Well-being*

I. INTRODUCTION

People and institutions that are flourishing share certain characteristics: higher productivity, more effective learning, more stable social ties, and better health and life expectancies [1]. This creates multiplier benefits for society: higher happiness levels can contribute to less expenditure on programming curbing social disintegration, lower healthcare costs, lower absenteeism, and overall "*performance*" increases [1]. Today's institutional indicators, notably turnover rates, performance assessments, and absentee tracking are no longer adequate, as they do not possess the multidimensional aspects and conditional factors needed to manage forward looking, transformative institutions. The challenge facing the management of on- and offline communities, as well as the overall success and health of institutions, is to identify fitting well-being indicators utilized in an appropriate method. For the purposes of this research "institution" and "community" are used synonymously.

Since the 1970's 'happiness research,' has looked at understanding and operationalizing well-being within and between people and institutions. Specifically, 'human flourishing' looks at the conditional factors of well-being [1, 2]. Subsequently, well-being and its indicators are beginning to be seen as one way to tackle the management of increasingly complex modern institutions. Well-being data, when responsibly collected at an institutional level, can drive proactive institutional management. However, due to cost and time barriers, well-being data are usually aggregated at the macro level [2]. These barriers

cause most well-being surveys to be performed on the national scale and via time-lapsed surveys and focus groups [3, 4, 5], an approach that lacks dexterity and granularity. The relative nature of well-being assessment makes it virtually unused in more nuanced research designs such as unobtrusive observation. This leaves an obvious research gap in gathering individually prompted data, especially in online settings.

Current national and international approaches lack specificity that can be used by individual institutions. Therefore, we propose to immerse data collection within online communities to enable a more powerful tool than those currently in use. A virtual community approach to well-being measurement creates a usable databank to assess and distinguish fluctuations between actual and expected well-being perceptions, an asset in stakeholder decision making and communication. Instrumenting a transition from largely aggregated perspectives of well-being to an individual perspective will dramatically affect the computational tractability of well-being measures.

When properly elicited and used, well-being is a highly multidimensional concept. Its use can enhance the understanding of overall health and vigor over time with robust acceptance from participants. The social gaming aspect and its potential to improve collaboration between stakeholders is well-being's main advantage over traditional management tools, as individuals' states of being can be integrated into a realtime user-stakeholder collaborative interface and tool. This is to say, if ones perception of higher personal quality of life indeed is connected to outcomes in such crucial domains as health and social integration, analyses of the related expectations are central to managing progressive and synchronized organizations and virtual communities.

Institutionally defined and managed well-being, however, requires a high level of trust between participants and stakeholders; the design of well-being as a decision service requires substantial support and participation. This type of data could be used to observe both public and private life domains. Participants will need to place significant trust in stakeholders to ensure validity and reliability of the data. Whereas responsible management would use well-being to view the institution's overall progress, satisfaction, and capacity, irresponsible management could use well-being data to pin-point users which do not "fit in" with institutional standards or desires.

With potential issues recognized, the prospective uses for well-being as a decision tool are still manifold. Well-being and its perception are linked to factors like (public) spending, health outputs, absenteeism, participation, and other general performance measures. The stakeholders of well-being range from small groups like online communities, institutions of universities or companies, civil society, and the larger research community. The Kingdom of Bhutan provides a point of refer-

ence of how well-being can be used as a framework for wider stakeholder accountabilities [6]. In the late 1980's, the kingdom conjoined externally imposed indicators such as GDP per capita and the state of the environment as a measurement of the state of health with a focus on national well-being assessments as the central key performance indicator in its Five Year Plan of development. As stated in the national planning guidelines: "*Apart from the obvious objectives of development: to increase GDP on a national level and incomes at the household level, development in Bhutan includes the achievement of less quantifiable objectives. These include ensuring the emotional well-being of the population, the preservation of Bhutan's cultural heritage and its rich and varied natural resources* [6, p22]."

This process has been furthered in two ways: time-lapsed surveys, and well-being framework integration. The surveys give status reports on the health and vigor of the nation, where framework integration serves to further the stated policies of governmental planning commissions. Frameworks of well-being and its conditions are being integrated into public programming and services, as well as national universities and the public bureaucracy [7]. Impressive results ensued: According to the United Nations Development Programme since the inception of its well-being focused Five Year Plans, Bhutan has made major strides [8]. Its GNI per capita of $1,005 (in 2005 dollars) was 40% higher than that of India, and over 70% higher than the average income of low income countries. The country's human development index grew from 0.325 in 1984 to 0.583 in 2003, placing Bhutan in the category of medium human development countries [8]. In implementing an enhanced indicator series Bhutan has a more reactive, finer tuned, and richer set of data from which to base its policy decisions.

In this paper, we explore the possibilities in the use of social network platforms for individually elicited, realtime well-being data. The novel approach to eliciting data proposed here is gamifying the measures of well-being within virtual communities. By introducing a gaming interface for self-reporting of participants, and to track bottom-up trending for stakeholders, our approach will allow well-being data to reveal not only diagnostic value, but predictive worth. A major challenge of this approach is truth revelation; without institutional confidence and assurance of data usage, participants will have little to no incentive to reveal their actual status. This is a design measure to be addressed and an institutional challenge.

Gamification addresses issues revolving around participation incentives through the use of techniques in social network propagation. By incentivizing participants to expand the game throughout their digital relationship base we can begin to reduce participation barriers. Thus, we propose a game setting addressing two aspects of social participation as a collaborative undertaking between members of an institution or community: gathering well-being data without significant entrance barriers, and tracking methods of network propagation to identify and understand relevant digital relationships and incentives of participation. To achieve these goals we identify the need to address the following research questions (RQ):

— **RQ1**. Will gamification of well-being data capture allow for the use of well-being as a basis for community management?

— **RQ2**. What are the important incentives for person to person (viral) social network participation?

— **RQ3**. Does a relationship between expectations of overall well-being and actual well-being have potential to be measured for predictive community management?

The paper is structured as follows: in an effort to address RQ One, Section 2 takes an overall look at well-being, its academic discussion, and an operational definition, followed by similar and complimentary work in social analysis. Section 3 works to address RQ Three in reviewing a small test of virtually-elicited well-being, and its implications on the relationship between well-being and decision support services. Section 4 addresses components and the design of the proposed game. Its design is delineated in the discussion of the vision, incentives, and uses of well-being games, and the limitations of the current approach to RQ Two. Sections 5 and 6 present future work in design and measures as well as a summary of this paper.

II. RELATED WORK

Changes in well-being are the basis of this research; changes allow tracking and thus institutional management. Changes in well-being are perception based and therefore depend on the individuals' frame of reference [9]. Personal and community well-being references can be framed around various institutional measures including economics, social relativity, education, health, and income parity [10]. These frames are driven in part by a personal assessment of how one feels [5] and an evaluation of one's ranking against community standards [9, 11]. One's expectations of well-being, as defined by their frame of reference, can be compared to the actual state of well-being overall. Continuing differences between these trajectories have predictive weight relevant to the health and vigor of individuals, communities, and institutions.

A. Defining well-being

The aim of well-being research is less to identify baseline personal motivation or purpose in life, and more to identify the feelings and conditions that contribute to happiness or the lack thereof. Interest in the well-being of people and communities as well as the corresponding definition can be traced back to the foundations of philosophy and political science, including works by Aristotle, Hobbes, and Fromm [12]. With roots in philosophy, politics, and psychology [12, 13], happiness research started its further development into socio-economics, which resulted in an exploration of well-being and its measurable conditions [10, 14]. There are two main schools of research and literature in modern well-being theory: subjective and psychological. While related, each research area has domain specificities which map well-being in diverse ways.

Subjective well-being, also called hedonistic well-being in related literature, is the most widely researched well-being categorization [5]. This sociological construct is devised and assessed by asking about one's total life satisfaction, the presence of well-being, and the absence of negative feelings [5]. This construct does not take into concern the conditions of well-being [10, p30]. New and revised work within this domain starts to include life satisfaction reporting [15]. A major drawback of subjective well-being measures is its reliance on personal recollection and the lack of assessment on consistent goals, activities, and attainments which can lead to well-being.

Criticism of hedonism coalesces around eudemonia (life satisfaction), or psychological well-being. Life satisfaction is

measured through surveys by an assortment of activities, constructs, and values, thus is concerned with the conditions of well-being rather than the feeling. Eudemonia allows for an alternative view of well-being, namely that what feels good and makes one happy doesn't always lead to meaningful expression or acting with integrity [12]. When critically assessed, eudemonia is a highly top-down approach. With a top-down expression of well-being attainment, there is a loss in individual's assertions of the things which make one well.

A progressive attempt to bind the two categorizations of well-being can be found in human flourishing. Human flourishing asks both how well the individual feels, and how one rates themself in various life constructs in the areas of positive emotion, competence, meaning, engagement, positive relationships, emotional stability, self-esteem, optimism, resilience, and vitality. Empirically validated and operationally defined by Huppert and So as "*the presence of positive emotion; having all but one of the features of positive function (PF); and, having all but one of the features of positive characteristics (PC)*", [2, p10] human flourishing helps link two separate yet equally important areas of the well-being academic discussion

This operationalized definition of well-being is an excellent representation of current well-being literature and its multidimensional properties. The layered structure of positive emotion, functioning, and characteristics is best suited for a game-like structure of well-being analysis, and is the most fitting with the interdisciplinary understanding of well-being that is in existent in research today. Though the named dimensions may not be an exhaustive list of the conditions of well-being, human flourishing as defined by Huppert and So is a theoretically sound baseline for realtime well-being assessment. Further discussion about the extension of the definition is outside of the scope of this work. For the purposes of this research well-being is a reference to the human flourishing construct.

B. Social network applications used in eScience

A previous work from Vella and Johnson is especially valuable in clarifying the use of gamification in terms of human flourishing [16]. Their work matches each of the ten human flourishing constructs with up to date findings from the gaming literature. Focusing on studies which relate to well-being or mental health of gamers, this work neatly ties the two sometimes disparate worlds of happiness research, gaming, and collaborative computing. This work does not however propose the design or mechanisms for a well-being game.

C. Means of analysis

In an earlier study on Facebook, called the "Gross National Happiness Index" [17] happiness is assessed using a word count sentiment analysis framework of 'public' status messages from a given country and language group. Initially only established for English speakers with a USA-based IP address, it has since started expanding to other language groups across 22 countries. This study used the "Text Analysis and Word Count" program with Hive data warehousing and a Hadoop framework to compile results. Gross National Happiness was converted into a score based on the equation:

$$GNH_d = \frac{\mu_{pd} - \mu_{p\bullet}}{\sigma_{p\bullet}} - \frac{\mu_{nd} - \mu_{n\bullet}}{\sigma_{n\bullet}}$$

(1)

with GNH_d representing gross national happiness for a specific day, μ_{id} the percent of positive (p) or negative (n) words for a given day (d) averaged across every user for a given country location. μ_i and σ_i are the average and standard deviation of daily averages, across the given time-series [17, p2]. There is a two day delay in reporting of GNH [17], yet it is the closest reporting mechanism of happiness based on near realtime data.

While a holistic approach to text analysis, there is no mechanism to relate seasonal verbiage such as "happy" [17] in English, a commonly used as a holiday salutation as such, thus giving an unreliable assumption of happiness around holidays and other milestones. This causes unnecessary seasonal spikes. Future studies must take the relational and syntactic structure of language used in analyzing well-being. Without an understanding of the meaning and usage of the language, proper assessment of the presence of positive and negative emotion, functioning and characteristics in text is not possible.

Another text analysis program (which was discussed in the Gross National Happiness work) is the Linguistic Inquiry and Word Count system (2007) [18]. Relating words to a content-validated dictionary, it separates text into various categories, thus can be used to help find underlying trends, and reduce researcher bias in assessing well-being. Currently available in eleven languages, LIWC gives opportunities to expand the game past traditional language boundaries. The dictionary structure is also more adaptive when searching for positive emotion, characteristics and functioning in text due its structured results approach. LIWC's output is divided into *"four general descriptor categories, 22 standard linguistic dimensions , 32 word categories tapping psychological constructs, seven personal concern categories, three paralinguistic dimensions, and 12 punctuation categories* [18, p4]." The table below proposes possible identifiers of the constructs of human flourishing based on a truncated list of categories.

LIWC 2007 Category	Corresponding Human Flourishing Construct(s)
Social processes (family, friends, humans)	All
Affective processes (positive emotion, negative emotions, anxiety, anger, sadness)	All
Cognitive processes (insight, causation, discrepancy, tentative, certainty, inhibition, inclusive, exclusive)	All
Perceptual processes (see, hear, feel)	All
Biological processes (body, health, sexual, ingestion)	Vitality, Resilience, Positive Relationships
Work	Competence, Meaning, Self-esteem, Engagement
Achievement	Competence, Meaning, Self-esteem

Table 1: LIWC2007[18] and Human Flourshing [2] comparison table

D. Well-being and predictive worth

A useful model for the utilization of well-being as a decision making aid was proposed by James Davies in his 1968 article on social unrest [19]. He suggests that drops in expectations as compared to actual progress fuels relative deprivation, the idea that deprivation is only experienced when compared to

others who are more fortunate (see Figure 1). In his model, a significant difference between actual and expected advancement reveals the overall health and vigor of the institution. This is a key research concept: as the model suggests, if relative deprivation is not in effect, social turmoil does not occur regardless of the actual state of well-being. Such a model has diagnostic value and can be exploited to have predictive worth.

The predictive worth of the model on socially-led change is the potential to be used in charting future public participation-based unrest and movements with the correct driving indicators. To this effect the game community's well-being data would be leveraged to provide actual and expected trending of flourishing. With concurrent supervision, components that can cause agency loss (i.e. statistically significant drops in flourishing data) can be proactively regulated as a form of adaptive community management. Applications for this sort of management tool are manifold: business, civil society, and public policy can benefit to name a few domains.
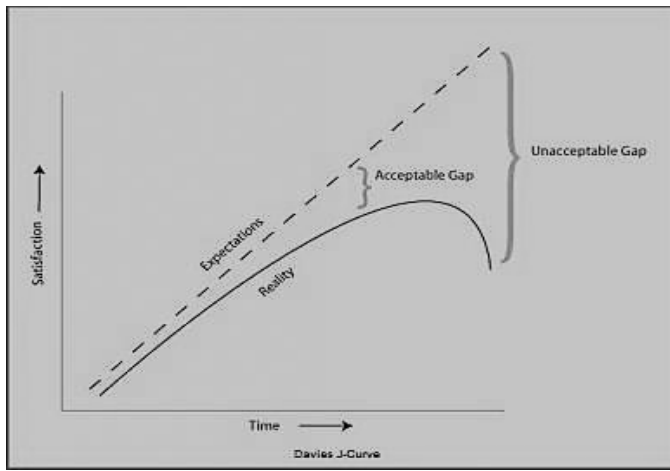

Figure 1. The Davies J-curve

III. EXPLORATIVE USE CASE IN THE FEASIBILITY OF ONLINE WELL-BEING

In order to test the use of human flourishing as an assessment of well-being, the related survey questions as defined by Huppert and So [2] were used in an online pretest and calculated. The ten questions were positioned online for one week and initially propagated through the main author's Facebook network. Questionnaires were available in English and German. All questions of the flourishing survey were mandatory, and optional demographic data of gender, age, place of residence, and highest completed education level were requested. This pretest served several purposes: first, the general willingness of users to participate in a well-being game; second, to test the proposed model; and third, to replicate the findings of Huppert and So in an online setting. The overall number of respondents and the corresponding completion rates are proxy variables for the willingness of users to provide information.

174 respondents completed the survey. Of these, 22.41% answered in German, 73% answered in English and 4.6% did not alter the language from the initial page. Respondents self-reported locations in North America (78), Europe (75), Asia (12) and Africa (1), with eight declinations to respond. 94 respondents self-reported their gender as 'Female', 74 as 'Male' and six respondents declined to report a gender. This gave a slightly higher response percentage from women (54%) than men (42.5%), a potential selection bias issue. Self-reported educational attainment shows 130 of the respondents hold at least a Bachelor's degree. The age distribution shows that most respondents are between 20 and 40 years old (Figure 3(a)[1]).

Huppert and So's work outlines the ten basic constructs of human flourishing as the presence of positive emotion, competence (c_1), meaning (c_2), engagement (c_3), positive relationships (c_4), emotional stability (f_1), self-esteem (f_2), optimism (f_3), resilience (f_4), and vitality (f_5). Taking their concept of human flourishing, we can mathematically represent it as:

$$HF = pe * \left(\left(1 - (1 - I_c)\right)\left(1 - (1 - I_f)\right)\left(\sum_{j=1}^{n} c_j + \sum_{k=1}^{m} f_k \right) \right)$$

$$I_c = \begin{cases} 1, & if \ |P_c| \geq n - 1 \\ 0, & else \end{cases}$$

$$I_f = \begin{cases} 1, & if \ |P_f| \geq m - 1 \\ 0, & else \end{cases}$$

$$P_c = \{c_j : c_j > 0\}, \quad P_f = \{f_k : f_k > 0\}$$

$$(2)$$

with HF is the total of the human flourishing subscores, where ranking on the human flourishing score requires the presence of *pe* (positive emotion). In addition to a *pe* score, HF can only be present/non-zero if at least n-1 PC constructs are positive, and at least m-1 PF constructs are positive (where *n* is the number of PC constructs and *m* the number of PF constructs: in this case *n*=4 and *m*=5).
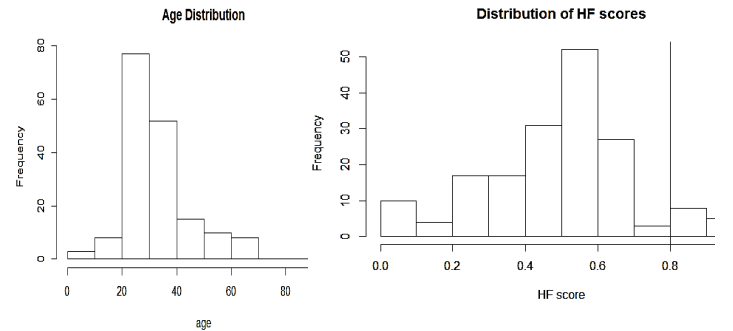

Figure 3: (a) Age distribution of the survey respondents, (b) Histogram of human floruishing scores

Based on the above formula of human flourishing, a raw, overall "flourishing score" was calculated according to Equation (2). The distribution of the HF scores is shown in Figure 3(b) as histogram, where the vertical line shows the cutoff value of 80% of the maximum achievable score, which was used by Huppert and So to distinguish between highly flourishing and the rest of the population in their initial study. The mean value of HF is 0.49, with a standard deviation of 0.20. Calculated at the .80 threshold, 13 participants (7%) would fit Huppert and So's definition of being highly flourishing.

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[1] One person responded with the age 99, which is probably meant to test the allowed age range of the question.

Further tests revealed that there was no statistically significant difference between HF based on gender, age or education[2]. However, a Wilcoxon test on the difference between HF reported from North America and Europe, (as well as a Kruskal-Wallis test between North America, Europe, and Asia) revealed statistically significant differences at the 1% level. See Figure 4 for the graphical representation of this observation.
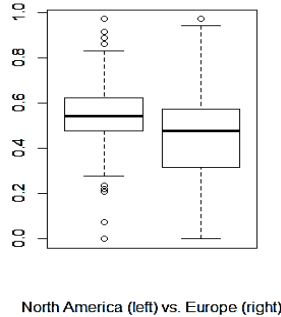

North America (left) vs. Europe (right)

Figure 4: Continental differences between North America and Europe

Considering the correlation values of the ten constructs of human flourishing (see the Spearman correlation values in Table 3), we see that there is a positive correlation between all constructs. This is not surprising based on the way that the HF is calculated. However, these correlations do not match the Spearmen's correlations found in the initial study [2]. As study replication in an online setting is a primary aim of this test, several possibilities must be considered. The conflicting results could be due to several factors including the small size of the pretest compared to the original study, the online propagation method, or the more varied population being measured. While the differences are an interesting observation, further discussion is out of scope for the current work.

	Positive Emotion	Competence	Engagement	Positive Relationships	Meaning	Emotional Stability	Optimism	Resilience	Self Esteem	Vitality
Positive Emotion	1.00									
Competence	0.60	1.00								
Engagement	0.28	0.27	1.00							
Positive Relationships	0.36	0.30	0.22	1.00						
Meaning	0.60	0.66	0.31	0.33	1.00					
Emotional Stability	0.49	0.35	0.17	0.16	0.32	1.00				
Optimism	0.46	0.43	0.32	0.36	0.50	0.34	1.00			
Resilience	0.19	0.13	0.09	0.08	0.08	0.18	0.30	1.00		
Self Esteem	0.51	0.37	0.39	0.30	0.46	0.44	0.57	0.31	1.00	
Vitality	0.49	0.37	0.35	0.24	0.45	0.53	0.32	0.19	0.53	1.00

Table 3: Spearman correlation values of human flourishing constructs

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[2] As the data is not normally distributed, non-parametric Mann-Whitney-U tests (Wilcoxon rank-sum tests) and Kruskal-Wallis-Tests were used.

IV. THE VISION AND DESIGN OF GAMIFIED WELL-BEING

Implementing and assessing the well-being of a community or institution via popularly propagated social gaming is a novel person to person mechanism in electronic and computational social science. In previous time series studies, well-being data has shown itself to be stable at the macro level [20], thus serving as a control element from which to measure change. A well-being game should be based on the ten existing and validated human flourishing constructs as this operationalized definition includes both the personal assessment of well-being and the conditions which lead to a personal assessment of well-being. Three flavors in the form of tasks and missions stand out as revelation techniques for well-being: pictographs, text, or a combination of the two. Along with this comes a question of differences between treatment groups depending on the representation of well-being depicted to be addressed.

We include the concept of layered reward systems on existing activity, with flourishing items as tasks, and entire constructs as missions to be completed, allowing point accumulation and level achievement. The ability to chart oneself, the gaming community, and earn points-based prizes serves as rewards and incentives for continued participation and propagation. Propagation is further encouraged via social action - reaction prompts on open profiles and direct invitation. Social interaction creates an incentive to participate, and reciprocate.

Eliciting well-being via a person to person game induces the experience of personal perception and social comparison within an online community. In gamifying, participants are incentivized to reveal their personal estimates and are encouraged to propagate the game further across their social graph. Tracking this person to person propagation is necessary for understanding how artifacts traverse the social graph.

A. BeWell: A game of you on Facebook

The interface will be built upon Facebook, with the possibility for later expansion to other networks and mobile apps, as well as a web interface. As the most popular social network platform with the most established APIs, Facebook is a prime platform for the inception and engineering of new participatory technologies to access well-being information.
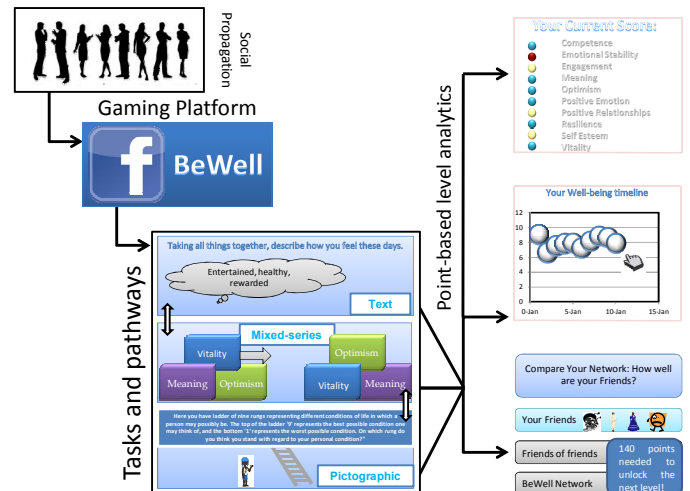

Figure 2: Component design, BeWell for Facebook

During registration, participants authorize baseline data access rights to demographic information including age, gend-

er, location and highest level of education. Demographics are central for clustering users based on common identity markers. When users are linked with various well-being aspects and common identity markers, clustering of users based on wider identity aspects than their initial network is enabled. Matching users not only within their network but with out-of-network similarities gives another level of data to drive well-being reporting as a more reactive management tool. Access to post on the participant's wall for achievements like level completion will also be sporadically requested as a social reinforcement of rewards, and a participation incentive mechanism.

Flourishing scores are accessible to participants throughout the game. A proposed update to Equation (1) for the purposes of network aggregations of daily human flourishing measurement take the form of the GNH daily measurement, but instead look at aggregation of time-specific flourishing data. This should have the least amount of time-delay possible build into the analytics to give rapid feedback to participants and community managers. Our proposed new formula for calculating daily human flourishing takes the form of HF_d representing a specific day of human flourishing within an institution, μ_{id} representing the reported positive (p) or negative (n) constructs for a given day (d) averaged across users for a given institution. μ_i and σ_i are the average and standard deviation of daily averages, across the given time-series.

B. Tasks, missions, and levels

Users traverse the game as an animated character. The interface is accessed in different echelons: a human flourishing related question set of tasks; the response mechanism; a portal to view personal game statistics, points, and flourishing score; and a pathway for individual and social comparison. Users are randomly placed in one of three treatment groups; upon completion of one flavor, users gain access to another pathway.

Tasks are the main activity of the game. Tasks are questions based on both on exogenous factors like weather and life events, and nine of ten constructs of flourishing (competence, meaning, engagement, positive relationships, emotional stability, self-esteem, optimism, resilience, and vitality). These nine constructs are the game missions. Tasks assigned in groups of either positive functioning or positive characteristics, and are pushed in a reminder format. Each task is offset by a question on positive emotion. Task completion is required to finish a construct. After a task series is done, the participant moves to the next flourishing construct. Users who finish all tasks in either of the missions comprising the positive functioning level or the positive characteristics level are rewarded with a level up to either the uncompleted level, or a new treatment group.

C. Treatments and pathways

The use of three treatments is a research innovation; previous surveys of well-being are done via a singularly formatted questionnaire or one-shot focus group [5, 20, 21]. However, using multiple treatments is a truth revelation mechanism as it checks the user's reporting of their flourishing level through three different representations. Other representations of well-being may reveal truer assessments.

Pictographic representations are the first treatment group. Participants are required to build flourishing related graphics to reveal well-being. Pictographic representations of well-being can be mapped to Likert scoring mechanisms based on the depiction of positivity and negativity in the self-constructed emoticons. The scaling is related to Huppert and So's validated flourishing scale [2]. Program analytics then convert the degree of movement of the pictographic by the participant to scores of well-being. Task completion means finalizing the pictograph.

Text analysis is the second treatment. Users give free-text answers to flourishing questions to complete missions. Text gathered from the responses is analyzed for correlation with the human flourishing category being tested. Additional clustering could be completed to search for commonalities in well-being representation between unaffiliated participants, revealing new dimensions of well-being definitions. Text-based responses are analyzed based on their correlating scores of positivity and negativity in the highlighted corresponding areas of flourishing using LIWC2007. Individuals with high personal assessments of well-being can be expected to use a high amount of positive emotion words, a low to moderate amount of negative emotion words, and words which correspond with positive functioning and positive characteristics [2]. Accordingly, text-based tasks are converted to human flourishing scores based on the presence and absence of positivity and negativity in responses.

The final treatment is a mixed-series between pictographic and text-based representation. The analytics function will read the terms and shapes of the exercise to score well-being. Similar to the text only treatment, additional clustering may reveal unpredicted aspects of well-being commonalities or functions that would otherwise remain hidden. This series allows for a more thorough comparison between both the balance question, and the other treatments. Like the pictographic treatment, task completion requires the completion of the entire exercise.

D. Point Accumulation

Successful completion of tasks and missions grants points that are redeemed for a variety of rewards (e.g., further access into the social graph, proposing rights for new levels, prizes, gift cards). Points are not the participants' well-being score. When point thresholds are reached via task completion, participants are elevated to new missions to complete increasingly complicated well-being tasks.

Points are granted not only for mission completion, but also propagation efforts. A baseline point bonus is given to users who propagate to friends at the time of registration. By granting points for introductory propagation, users are enticed to continue both playing and propagating. High propagation participants receive an additional bonus point bundle if threshold levels amounts of users linked to the gamer participate.

A profile screen grants each participant full access to view their own well-being history, and points comprised of task, mission, and level completion. Point scores and the gaming network's aggregated well-being scores are also accessible in the profile. Beginning with their personal network, users unlock the aggregate scores of further extensions of the games social graph with level completion. This use of personal versus social comparison is in place as a participation incentive, as social comparison is only accessible with point accumulation.

E. Social comparison and ranking

Social comparison, or the process by which individuals relate their own characteristics to those of others [11, 19, 22], is a way for individuals to assign heuristics to life facets. Well-being is not anathema to this; rather, it is a basic social utility

function. Individual level of satisfaction is a function of the outcomes of both the individuals and the chosen community [22, p427]. Well-being is in part assessed by knowing or assuming how others are doing when referenced against one's own expectations, and how one is doing against a current reference group [10, 11]. Changes in well-being are to some extent driven from external influences as much as driven by internal expectations, as can be seen in Frey and Stutzer's assessment of the effects of unemployment on the greater reference group. Their findings indicate when all other influences are held constant, widespread unemployment lowers happiness even in those who are employed by two percentage points across the general population [10, p 101]. External comparison lends itself as a component of personal well-being assessment.

Without this benchmark, game participants are missing an essential part of the well-being frame of reference. Thus, it is important to research the value of personal history comparison and its relation to social comparison in well-being assessments. Tapping into social comparison will be important to understanding how people spread information through their respective networks, and to see motivation for continued participation in the game. Tracking game propagation mirrors digital relationships, as people chose to propagate to the groups against which they benchmark life standards and goals [5, p 203].

However, the issue continues to exist that personal and public information revelation is driven by different motivations. Specifically, within a possible group with a preference to maintain higher status, there could be an incentive to not truthfully reveal their well-being information [23]. To incur incentive compatibility, the analytics of the program do not allow for friend to friend comparison, rather person to aggregate network comparison. Additionally, a confidential survey on the complete human flourishing scale will be randomly distributed to participants after several months. The full survey will take the form of a bonus level and will be rewarded with additional points. Results of this survey will show to what extent, if at all, that social comparison changes the answers of users.

F. Propagation

The analytics simultaneously track propagation mechanisms of the game (the way in which users recommend or advertise the game) and participation in the game (an individual's usage). Tracking propagation helps define online relationships; understanding online relationships is necessary when utilizing social comparison as a feedback mechanism. Participation in the game is the way in which users populate the data map. Individual well-being scores, defined by survey responses to human flourishing questions, are the means by which one creates their own well-being map.

From the perspective of institution or community management, understanding group anatomies and social structures not only aids game design, but also provides an additional management context. For example, a participant with a "poor" well-being score may in parallel be socially isolated (e.g. new employee). Therefore having access to the social graph can help in the implementation of mechanisms to improve well-being or tackle aspects of poor well-being. Looking instead at the implementation aspects of the game, understanding how users draw in their friends, and the factors that motivate them

to do so, enables a better understanding of the relevant social channels. This is important, as without properly addressing the ability to reach as many potential participants as possible, the usefulness of well-being measures, as an indicator for community and institution health, is limited. For this reason, we will observe which methods of propagation are most effective for given participant clusters.

G. Examining the use cases of gamified well-being

Complex, modern institutions do and will face unprecedented personnel management issues, and thus need whole-person, transformative tools. Well-being games in the terms of online communities and public participation can help spot the advent of agency loss; a flourishing game in an institution like a university or company could be utilized as a key performance indicator to replace stakeholder satisfaction measures, much like what was undertaken in Bhutan [7]. Leaders and managers alike can use popularly propagated well-being assessments to chart the rises and falls of robustness within their group or institution. Table 2 shows flourishing constructs and their potential use in decision making in the areas of agency loss, productivity, healthcare costs, and employee satisfaction.

Flourishing Construct	Decision support
Positive Emotion	All
Competence	Agency loss, Productivity
Meaning	Agency loss
Engagement	Agency loss, Productivity
Positive Relationships	Employee Satisfaction, Agency loss
Emotional Stability	Healthcare costs
Self-esteem	Employee Satisfaction
Optimism	All
Resilience	Healthcare costs
Vitality	Productivity, Healthcare costs

Table 2: The author's human flourishing [2] and potential decision support tools comparison table

Well-being as a management tool is underutilized in policy due to what Ahn, Choi, and Kim call a lack of solid theoretical base and "policy-friendliness" [24, p2], hesitance to have policy derived from affective states and adaptive preferences, and possible conflicts with other necessary values or structures [23]. Recent developments in the scope and recommendations of happiness research have made it more palatable to the policy makers [10, 14]. Still, uneven data access and a reluctance to allow well-being to do more than inform policy is still hampering efforts to introduce well-being as a global framework [21]. However, understanding the 'wellness' of an institution provides a transformative level of access into policy planning and public acceptance. As can be seen by the preliminary suggestions of Table 2, flourishing constructs and data are complimentary to decision support tools.

V. NEXT STEPS

The mismatch between the pretest observations and the results of Huppert and So could be due to several factors, among them the size of the survey, the length of available days to answer the questionnaire, selection bias due to the e-format, and

the population increase from a focus solely on Europe to a wider continental response base. Each of these issues will be more acutely addressed in the game design, along with potential issues of dishonesty (i.e. blindly answering for rewards, untruthful responses). Emerging studies in big data and crowdsourcing could also determine the reasons behind the differing results between the pretest and original study [2].

The influence of the different constructs on the HF score according to Equation (2) must also be tested. Our Wilcoxon tests indicate that there is a significant difference between HF score populations at the 0.1% level if we disregard *pe*, but not if we disregard either the PF or PC construct. In the latter case, dummy variables for the constructs *pe*, PF and PC can be introduced to test for the significance on the individual score level. The dummy variable calculation process also supports adding missions popularly proposed by users. One reward of the game is that with high level completion, participants can propose well-being missions or additional game tasks that align to flourishing [16]. Both the current definition and proposals may lead to the establishment of unforeseen attribute matching and a new operational definition. This is left for future work.

VI. CONCLUDING REMARKS

In this paper, we propose a gamified approach to well-being data collection, some potential overlapping decision areas, and challenges to trust in sharing of well-being information. Well-being is a theme of discussion with links to the foundations of modern philosophy. An ongoing challenge and possible limitation, its measurement and uses still have yet to be fully and definitively demarcated. Well-being data accessed via social gaming is a "*lever of change*" [2, p 25] for progressive management. Person to person in nature and backed by highly sensitive computing facilities, well-being games are a means to support the design and management of complex institutions and virtual communities.

We have evaluated the feasibility of acquiring well-being data via online social networks. Despite the short time frame of one week and only the main authors personal network as a starting point, we demonstrated that users are willing to reveal personal information via social relationships digitally encoded within online platforms. In addition, we explored whether similar results in well-being could be observed in online settings to traditional forms of data acquisition.

The potential data gained from this game will have several characteristics. It will be sensitive, as it deals with personal standards and perceptions; it can be noisy, due to the tri-flavor collection method and propagation tracking; and while correlation potential between the interplaying factors is possible, causation is nearly impossible to reach at this stage. Computer analytics with a high degree of sensitivity are required to make well-being analysis feasible.

We argue that well-being is not a concept to be kept in the domain of social sciences. Well-being and its measurement must be moved into the realm of collaborative eScience. Without a large scale transfer of functionality and data analysis, realtime measurement cannot be feasibly managed. As personal and institutional well-being is central to overall assessments, well-being must be accordingly configured.

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