Collective Intelligence or Group Think? Engaging Participation Patterns in *World without Oil*

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ABSTRACT
This article presents an analysis of participation patterns in an Alternate Reality Game, World Without Oil. This game aims to bring people together in an online environment to reflect on how an oil crisis might affect their lives and communities as a way to both counter such a crisis and to build collective intelligence about responding to it. We present a series of participation profiles based on a quantitative analysis of 1554 contributions to the game narrative made by 322 players. We further qualitatively analyze a sample of these contributions. We outline the dominant themes, the majority of which engage the global oil crisis for its effects on commute options and present micro-sustainability solutions in response. We further draw on the quantitative and qualitative analysis of this space to discuss how the design of the game, specifically its framing of the problem, feedback mechanism, and absence of subject-matter expertise, counter its aim of generating collective intelligence, making it conducive to groupthink.

Author Keywords
Alternate Reality Games; Participation; Collective Intelligence; Groupthink

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
Alternate Reality Games (ARGs) are a specific set of games that are based on collaborative problem solving and storytelling. These games have been part of the gaming landscape since around 2001 as transmedia entertainment or promotional pieces for product launches [10, 13, 14]. Recently, a second wave of ARGs seeks to address societal issues (e.g., poverty and hunger) through widespread collaboration. It's been argued that such environments are a powerful means of engaging participants in awareness-building, collective intelligence, and participatory forms of learning [11, 16, 17].

However, much the current literature on the success of ARGs relies heavily on the observations of ARG designers and developers [e.g., 6, 17] as opposed to empirical evidence of player participation (with few exceptions such as [20, 23, 24]). If we are to take the claims of ARG proponents seriously, we need to address key questions, among them: what are the kinds of engagement fostered in these environments?; and are these engagements generative of collective intelligence and innovative problem solving?

This paper presents a study of one ARG, World Without Oil (WWO), seeking to address the above questions. Based on quantitative analysis of player responses, we put forward a set of participation profiles that characterize different levels of engagement. We further analyze a sample of these contributions by thematically coding their content. We outline the dominant themes, the majority of which engage the global oil crisis for its effects on commute options and present micro-sustainability solutions in response.

This paper's contribution is multifaceted. Through the case study of WWO, we critically engage one of the key arguments in support of ARGs: that they are environments generative of collective intelligence. Based on this study, we illustrate that the narrative is dominated by a limited set of themes and a small group of highly active participants including the designers of the game who refer to themselves as *puppet masters*. We further discuss the characteristics that run counter to the objective of collective intelligence, making the environment susceptible to groupthink. Based on this study, we highlight a set of design considerations that are key in success of ARGs if they are to avoid the problems related to groupthink, among them: balancing the number of players with different participation profiles; including the voice of subject matter experts; encouraging critical thinking alongside cooperative and collaborative practices; and provision of markers for players to distinguish reality from fiction and facts from misinformation. In doing so, we contribute to existing research on the social aspects of gaming as well as the larger scholarship on (mediated) group interactions and online communities.

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BACKGROUND AND PREVIOUS WORK

ARGs are multi-player narratives that involve online and offline participation, using a variety of tasks, challenges, puzzles, and prompts to engage players in co-constructing a fictional scenario. One or more "puppet masters" guide the narrative and serve as architects of user participation, often drawing on player engagement to alter the narrative flow, encourage specific forms of participation, or redirect player efforts. As a kind of emergent, interactive problem-based story, the ARG genre combines elements of live action role-play, transmedia storytelling, and cooperative games. Gurzick and colleagues [9, 10] suggest that ARGs are a type of self-organizing collective, similar in some ways to Wikipedia and other open content development spaces. Analyzing the characteristics of ARGs may lend insights to the development of new gaming experiences as well as organizational groupware systems.

One of the key characteristics of ARGs is that they require players to perform tasks or act in the world and then document and report these actions in response to the fictional "situations" that are presented to them. The online and offline components constitute different kinds of engagement that may be considered a kind of "move". Some moves are public, as when a player documents or responds to the game through social media, a blog post, or a public action at the prompt of other players or the puppet masters. Some of these moves may be private, as when a player changes his awareness, behavior, or attitude concerning the topic of game play. The moves, in aggregate, constitute the narrative of the game. One can argue that multiple narratives are created in this process: the personal or private narrative, comprised of the individual's self-constructed "story" of the game and their part in it, and the social or public narrative, which is the combined effort of all the players including the puppet masters.

The interplay between these public and private narratives is where ARGs have the potential to be rich spaces for innovation and knowledge building. As players engage in reflection on their own moves and the moves of others, they are experiencing a form of learning through individual and collective storytelling and listening [5]. The quality of this learning depends on the level and quality of the participatory opportunities offered by the game narrative, and the extent to which players engage with the narrative and each other [12]. Thus, analyzing participation patterns in these collaborative narratives is an important aspect of understanding whether or not ARGs live up to dominant discourse, which presents them as sources of collective intelligence.

More specifically, the discourse around ARGs echoes one of the most dominant themes of social tools and web 2.0 celebrating the power and wisdom of the 'crowds' [e.g., 3, 27, 29]. ARGs present a specific interpretation of collective intelligence: collaborative and creative environments that bring people together to solve real-world problems [e.g., 4, 5]. Drawing on the work of Pierre Levy, Jane McGonigal, one of the prominent advocates of ARGs, argues that members of a collective intelligence *would work with the collected facts and viewpoints to actively author, discover and invent new, computer-fueled ways of thinking, strategizing, and coordinating* [18, 15, 17]. However, while the diversity and talents of group members can be a great resource for collaborative problem solving, such groups are susceptible to group think, *a mode of thinking that people engage in when they are deeply involved in a cohesive in-group, and members' strivings for unanimity override their motivation to realistically appraise alternative courses of action* [12]. In this study, we examine this challenge in WWO and discuss some of the design strategies that can potentially counter groupthink.

WORLD WITHOUT OIL

World Without Oil is a massively collaborative imagining of the first 32 weeks of a global oil crisis. Designed by Ken Eklund (Creative Director) and Jane McGonigal (Participation Architect), the game aims to bring people together around a shared concern, namely getting them to reflect and share insights about oil dependence with the aim of devising plausible and effective courses of action in response to an "oil shock" scenario. Two aims are central to the design of WWO: one, that individuals can initiate change if they are motivated; two, that difficult problems can be solved by a diverse group of people coming together to share their individual perspectives and come up with innovative solutions to encounter the situation, the sum of which leads to a kind of collective intelligence. In what follows we describe the design of the game in detail.

Design

Scenario

The game's main site of interaction is the website worldwithoutoil.org. As noted earlier, the game is built around the premise that an oil shock arrived on April 30, 2007. Starting with the initial news that "gas prices have risen to $7[1]," the puppet masters shared the day-to-day news of a global oil shock on the website. Each day of the game represented a week of the imagined crisis with the unfolding events simulating eight months of an imagined crisis. For the period of 32 days, the puppet masters, who also acted as game characters, shared fake but realistic news, stories, commentary, resources, and activities related to the unfolding of the oil shock. Players were challenged to respond in creative ways. They were asked to share stories about how their lives were affected and strategies they employed to confront the crisis. Their stories were incorporated into the narrative in concert with the ones created by the puppet masters, to which others players could react and respond.

[1] $7/gallon is roughly three times the average price of gasoline in the U.S. in 2007.

Participation

To facilitate various forms of contribution, the game environment did not set limitations on participation. Anyone could register to play and contribute to the collective narrative. There were also no limitations about entering or exiting the game or any requirements as to the intensity of participation such as a minimum or maximum number of entries. One could participate with one post, or a series of posts. Similarly, people could choose to participate through the communication method of their choice. As a result, some wrote on their weblogs or made videos or images. Others played by email or called a number to share their stories. Lastly, there were no rules about what people should say or do in relationship to the game.

One of the main features of the game is a series of missions designed to help players make actual changes and act in response to the simulated crisis. On the game's website, missions are described as *creative, real-world actions that respond to our new world without oil*. The game designers (i.e., its puppet masters), who also took part in the game as characters, assigned most of the missions. Players could also set up new missions to which other players and puppet masters could respond.

Interface

On the homepage, the game is explained in detail, including pages outlining its history and how-to play guides. The main areas that draw attention on the homepage are the *dashboard*, a white banner at the top of the site which details the oil prices of the day (representing a week of the crisis), followed by the first few sentences of the main scenario of the week, together with links for joining the game and reading the blog. On the left, there is a banner with the list of all the weeks' contributions, putting the highest-ranking posts on the top.

One webpage is dedicated to each day of the game. On this webpage we see an "update" of the news of that week posted by the designers. These stories set the theme for each day of the game. Following the updates, all the posts by the players are included in (seemingly) chronological order.

Feedback

The dashboard included responses from players in different regions based on the level of activity and whether responses are positive (e.g., positive forecasts, cooperative strategies, actively reducing daily oil consumption) or negative (e.g. reporting a darker turn of events, focusing on competition, or difficulties to adapt to low energy consumption) [16, p. 307]. Players are also ranked based on the frequency of their contributions and what appears to be a subjective rating of the quality of their contribution by the designers. The website explains:

> ***Scores:*** *The way people get a higher score depends on what they contribute, and how often.[…]*
>
> ***Areas:*** *The area rankings are based on a combination of how much and how cool is the stuff people in the area are doing, and how many people from the area are doing anything. […]*
>
> *There is a certain amount of furry logic though, not to mention I suspect some of my colleagues will succumb to arm twisting and go in and fiddle with the scores :(*

Aim 1. Positive Behavior Change

The first concept central to the design of WWO is that individuals are creative and capable of initiating change. However, in real life they lack the motivation to take action. As a result, the game aims to provide motivation and remove the negative pressures associated with making changes in real life. According to McGonigal, real life can be "fixed" by creating scenarios and reward systems that motivate people to act in more positive ways. These scenarios can be applied to a range of tasks and activities ranging from household chores to "saving the world" [16].

Aim 2. Collective Intelligence

The second concept that is central to the design of WWO is the ability of a diverse group of people with different life experiences to devise innovative solutions to complex problems. Being experts in their own needs, it is individuals who can best imagine how their everyday practices might change in a hypothetical situation such as an oil crisis. By engaging in realistic scenarios and stories, players are contributing to a collective intelligence on the issue of oil dependence. Through their participation, players raise their awareness of environmental issues and devise innovative strategies to lessen their dependence on oil. At the same time, the entire community can learn from the players' responses because they present a diversity of ways that one might prepare for and/or survive in a world without oil. Summarized in the words of Jane McGonigal, "World without Oil would give players firsthand insight into a plausible future, help them prepare for, or even prevent, its worst outcomes. The game would create a collective record of how a real peak-oil scenario might play out — a kind of survival guide for the future, a record of tremendous value for educators, policy makers and organizations of all kinds."

METHOD

According to the WWO website, over 1,900 people signed up as players of WWO, and submitted over 1,500 stories with over 60,000 active observers [16]. However, these numbers tell us very little about the character of participation, and how individual contributors shaped the game narrative. To better understand participation patterns at a granular level, we constructed a database of participant contributions–an aggregate record of the game narrative–that we could explore quantitatively and qualitatively.

Basic metadata about participation in the game is hosted in two places: on the archived WWO site itself and an offsite archive set up by the game designers in partnership with the Internet Archive's Wayback Machine. While the WWO site still exists, many of the links to the original posts are no

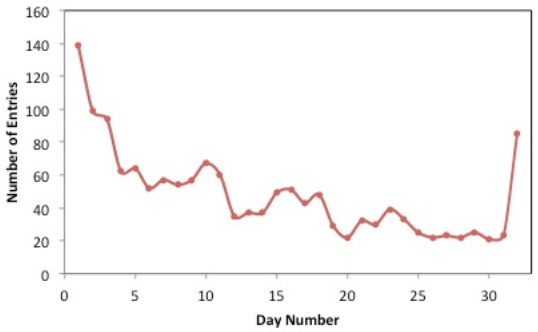

Figure 1: Total number of entries per day versus days passed

longer valid. The game archive captured 94% of the content from the posts made during the game's active period of 32 days (with some gaps most likely related to participants deleting their own posts prior to the construction of the archive). Our database includes 86 audio files, 1165 blog entries, 117 images, 114 emails, and 75 videos.

We used linked relational databases, MS Excel, and SPSS 22 to identify a set of participation profiles based on several criteria: post types, frequency of contribution, and distribution of contributions, both in relation to the game sequence and each other. We used contextual factors, including URLs, location IDs, and other trace data to identify, where possible, when the same person(s) made contributions with slightly different UserIDs. This quantitative analysis was complemented by a qualitative study of a random set of 232 entries from this set (15%). In what follows we describe these analyses in detail.

QUANTITATIVE ANALYSIS

It has been noted that WWO attracted 60,000 unique views, and over 1500 contributions from players across several continents [16]. At face value, these are impressive numbers. However, exploring the participation patterns in detail, we see that engaged participation was not as broad as these numbers might suggest. Furthermore, our analysis reveals high attrition rates among participants early in the simulation, and a small number of contributors authoring the majority of the narrative.

The overall trend in contributions shows a sharp decline at the beginning, with the first day being the highest participation rate, strong declines over the first five days, then steady decline in posting with a brief uptick at the end (Figure 1).

If we use contributions to the game narrative as one measure of engagement, we can identify three groups: limited, moderate and high engagement. We considered limited engagement 4 or fewer posts (an average of once per week of the simulation or less); 227 of the 308 participants (excluding WWO puppetmasters) fall into this category, accounting for 367 posts. Moderate engagement was set at 5–9 contributions to the game; 38 participants engaged at this level, accounting for 244 posts. There were 43 high-engagement players, those who submitted 10 or more posts (at least every third day of the simulation on average), accounting for 827 posts.

With an open game narrative like WWO, one would expect there to be more persons interested in observing the simulation than active players constructing the narrative. However, we see the ratio of contributing participants to lurkers even smaller than expected. The 30 most frequent participants (top 10% by number of posts) accounted for roughly 50% of contributions. The 60 most frequent participants (top 20%) accounted for roughly 67% of contributions. These ratios are slightly better than the Pareto Rule, a marketing maxim that suggests 20% of customers produce 80% of sales [26]. However, the number of unique hits on the site during the 32 days of the simulation numbered over 60,000. The number of contributors, then, is less than 1% of all those who expressed interest in the simulation itself. Furthermore, we see that the ratio of highly engaged participants to all participants is exceptionally small, with only a few dozen contributors accounting for most of the narrative, and over 50% attrition of active contributors at the midway point of the simulation. These numbers conform to the "1% rule," which states that 90% of participants in online communities lurk, 9% contribute intermittently, 1% account for nearly all the activity [19, 30]. ARGs, then, share similarities in participation patterns with crowd-sourced knowledge spaces like Wikipedia, as well as healthcare social network sites [21, 30].

Player Participation Profiles

Game participation patterns, when examined at the level of the individual contributor, reveal a number of "profiles" or clusters of participant behavior. These profiles provide insights as to how the game mechanics may have influenced user engagement, particularly maintaining participant interest over time. Narratively and in Table 1 we document the nature and frequency of these profiles.

Toe Dippers – these players posted a single contribution, or in 13 cases contributed two times on the same day, but thereafter did not contribute again. We identified 150 players as Toe Dippers, 46.6% of active contributors. The majority of Toe-dippers contributed early in the game; 57% contributed in the first five days; 87% prior to day 16.

Lurkers – these players also posted a single contribution to the game narrative, but on the final day of the simulation, and with some evidence in the post that they had been reading and engaging with the WWO story. We identified 18 lurkers, comprising 5.6% of contributors. We call out this group as they demonstrate the kind of summative reflection that may be overlooked by exploring the player profiles strictly algorithmically.

Drop-Outs – these players posted frequently in the early days of the simulation, then fell away by the middle, with no posts past the mid-way point of the game. We labeled 65 players as drop-outs, 20.2% of players. Of these, 24 players

Profile	Players		Posts	
Toe-dippers	150	46.6%	164	10.6%
Lurkers	18	5.6%	20	1.3%
Drop-outs	65	20.2%	395	25.4%
Late-comers	15	4.7%	114	7.3%
Regulars	39	12.1%	689	44.3%
Designers	14	4.3%	68	4.4%
No Profile	21	6.5%	56	3.6%
*Unidentified**			48	3.1%

Table 1: Participant profiles by frequency and their contribution to the game narrative.

posted 3 or more times in the first five days, but were not heard from again, suggesting initial excitement that did not lead to continued engagement.

Late-Comers – players who joined the game in the second half of the simulation, contributing regularly between days 20 and 32. Some of this later interest may have been driven by documentation of WWO on public radio, which partially funded the development of the game. The Late-Comers profile accounts for 15 players, only 4.7% of active contributors. This includes some participants who did not actively contribute to the game narrative until the final week.

Regulars – only 39 players (12.1% of active contributors) participated steadily throughout the game, posting 5 or more times (greater than once per week) including posts in the final days of the simulation. We used standard deviation to account for post spread to eliminate players who may have posted a flurry of contributions in the final week (distinguishing Late-Comers from Regulars). A subset of this group, the hyper-engaged, totaling 9 players, posted more than 25 times apiece. Although comprising 1/8 of the players, this group, along with the game designers, submitted nearly half the narrative content.

QUALITATIVE ANALYSIS

As we noted in the introductory sections, WWO has been praised as a space for collective intelligence as it focuses on *producing new discourse about a global energy crisis* [i.e., 4]. However, such arguments rely heavily on anecdotal evidence from designers or a small set of players [6, 17]. To understand the nature of participation by players, we thematically coded a selection of 230 posts from the database. This selection included a random set of 130 entries spanning various days during the game interval. We also randomly selected a set of another 100 entries that were listed as award winners, were posted by puppet masters, or included comments by the puppet masters.

Our analysis and thematic coding of entries was focused on our research question: are the scenarios and practices put forward by the players innovative in ways that would lead us to think of the WWO ARG as a space that is generative of innovative problem solving and collective intelligence? Our thematic analysis leads us to four themes related to short-term and long-term changes as described below:

Disruptions in Everyday Routines and Practices

One of the dominant themes among the responses (and perhaps an expected one give the scenario set by puppet masters) is that of the immediate disruption of everyday practices. The disruptions range from minor to major. The entries describe long lines at the gas stations; power outages; rationing of fuel or food; inability to pay for everyday necessities such as food or medicine; money and goods losing their value; job loss; being stranded at airports; breakdown of services such as healthcare or postal services; blackouts; or the inability of the public transportation infrastructure to bear the load. For example, player Cid Yama writes about the effect of fuel prices on the car market and purchasing power of individuals,

"*Riding my bike to work has made me more aware of what's going on around town. More and more SUV's and Pick-Up's are up for sale "by owner". The dealerships are offering practically nothing for trade-ins on these vehicles.[…] Jobs up here are few and far between. Their paychecks have to be mostly going to gas to get to work. I can't even imagine." – Player Cid Yama (Regular)*[2]

Micro-sustainability

In addition to recounting ongoing changes (i.e., disruptions in everyday life), players describe how they are coping. The dominant theme in these responses is micro sustainability, focusing on small individual actions. Subthemes include alternate commute (e.g., biking); alternate food (buying local food, starting a garden); alternate energy (e.g., investing in solar energy); or buying a fuel-efficient car. For example, *hideousallusion* writes:

"Workwise, I am in a position to help- both my jobs are poised to assist the alternative economy (one more than the other.) My regular job is Carpool Coordination and my other gig as at the Santa Cruz Farmers' Market, which I'm sure will be essential to regional operations in any serious crashlike scenario. I do worry about the farmers, and how they will get their goods to market if they are fuel-poor.

I need to get my 3-speed in working order soon, and get some tools and essentials together. I wish I knew some of my neighbors better and could get them hip to the situation- some of them have very large lots/fields around their houses that will be essential for times like this- communal composting toilets, community gardens, tent cities etc. […]" –Player hideousallusion (Toe-dipper)[3]

[2] http://wayback.archive-it.org/690/20070511045848/http://cid-yama.livejournal.com/1285.html

[3] http://hideousallusion.livejournal.com/41737.html

Another set of entries under micro-sustainability focus on preparedness and acquiring new expertise, such as:

"[…]So if you're an accountant or website designer or social studies teacher- that's not enough. […]. You may need these other skills both to earn cash or barter with others or for your own household. What sorts of skills? Well for starters, how about bike repair, carpentry, plumbing, knitting, sewing/repairs, bread baking, wildcrafting, cheesemaking or whatever else you find interesting or useful. Nobody can take these away from you- they're different than "stuff"." – Player blueski (Regular)[4]

On day 3 of the game, in an entry titled "It's time to start experimenting!", puppet master *mpathytest* puts forward the following: *This is what I believe: Shock helps solve problems we would otherwise ignore. Shock turns us into innovators. […] When things get hard, when normal stops working, we will innovate. We will re-design our everyday lives. We will hack the way our neighborhoods work. We will re-engineer society.* Following this statement, she poses the following challenge to players:

And we need your brain to help us come up with completely original, maybe slightly crazy, ideas for banding together and living without as much oil as we're used to.

The responses to this challenge were of particular interest to us as we were interested in innovative strategies that emerged from the game. However, based on our analysis, the so-called *crazy ideas* put forward by players in response to this challenge also fall under the theme of micro-sustainability. The two entries below are representative:

"*I threw up the question about how it is that those guys could transport larger items or large amounts of items. How did they get their flatpacks home from Ikea? So we had this pretty wacky brainwave of welding two bikes together with a large carrying basket in between the two. That way, not only could we have a way to move larger stuff around, with twice the power being applied to the vehicle, we could go a little faster too when we were unloaded." – Player drowned_saved (Drop-out)*

"Although our supplies are weakening, we see hope and have taken up alternate means to survive.

Being in near perfect weather, with lots of plants growing, we started our garden. Although it is thriving, it is not fully operational. Will report more news on our garden soon.

We have started exploring the blocks around our home, looking for edible plants. We'll archive some spots in our neighborhood to eat for free, in the alleys and in the streets there may be enough to keep us going." –eek (Regular)[5]

[4] http://rdy2rte.livejournal.com/2239.html

[5] http://wayback.archive-it.org/690/20070511045852/http:/www.polka.com/worldwithoutoil/

Scenarios of Chaos, War, and Stress

In their responses to the game, players also engage with the long-term implications of an oil crisis. Some players' responses describe a world of chaos, war, and stress. Examples include new conflicts over resources such as news of the US military headed to Alberta borders to take over the oil reserves;[6] burning down gas stations;[7] assaults and gas theft.[8] For example, player *fabulareine (Drop-out)* asks,

Will we soon have drug mules crossing the Mexican border smuggling coffee beans instead of meth?[9]

Other players describe how the situation is leading to radical behaviors and personal choices such as the following:

"*I've raped my existing customers, (who all trust me very deeply,) only staying somewhat true to my "bread and butter" client. For that client, I openly, honestly, and cheaply implemented systems that can allow the entire workforce to work from home. I even went as far as installing unlicensed software, as nobody is going to find out anyway. Yes, I still charged them for it. Lots.*

[…]I am a one man source of disinformation, citing abiotic oil and every other anti-peak-oil reference I can find. I've convinced a good portion of my clients that this is temporary, turning around in 90-120 days. I've even done this with co-workers and friends. I've gone as far as writing fake news articles, and emailing them to those that aren't blood." –Player Fosedeitch (Drop-out)[10]

While we will discuss the lack of credibility and guidance later in this article, it is important to note here that the above post does not receive any dissenting comments and the troubling language in the post remains unchecked.

Scenarios of Hope, Community, and Return to Primitive Practices

In imagining the scenarios of a future without oil, and in contrast to the above, some players anticipate a return to primitive practices in tandem with the themes of hope, community, and individual resilience.

For example, player *lead_tag (Regular)* recommends that players take four items into the approaching twilight of our advanced age: an axe, an awl, a knife, and a file to survive. An axe is useful for instance as it is,

The oldest manufactured tool and the most useful, it can do most of the cutting tasks required by humans from the smallest to the most ambitious (think skinning a rabbit to felling a redwood). Cutting wood for fuel, the spark to light it when struck with a flint, the timbers for a shelter, protection as a weapon, a

[6] http://hideousallusion.livejournal.com/41737.html

[7] http://fallingintosin.livejournal.com/3311.html

[8] http://wayback.archive-it.org/690/20070511045847/http://midasmulligan.livejournal.com/998.html

[9] http://fabulareine.livejournal.com/2116.html

[10] http://fosedeitch.livejournal.com/1741.html

hammer to pound with using the poll, and should you care to abuse it, a tool to dig with, all this an axe can provide.

Anticipating a similar scenario, Player *Degaussed (Drop-out)* writes:

"Until my lifestyle becomes natural enough to gather, I've planted a garden. I've also spent some time on indian [sic] reservations, where the old ways are still sometimes practiced. Learning how to tan hides, how to make weapons, how to hunt your own food with your own tools. Things will be pretty messy for a while, but...

It will be for the best. This will all be for the best. Money won't be worth anything for much longer anyways, so I'm stocking up on sustainables [sic] and learning as much as I can." —player Degaussed[11]

In this scenario the absence of oil and the failure of infrastructures, organizations, and government is translated into messages of optimism, hope, self-reliance, and community. For example, player *the fiddler (Drop-out)* writes:

Aside from working together we are also sharing food. Every Sunday the whole community comes together to break bread potluck-style at someone's home. The atmosphere is both jovial and serious. We laugh at life's small mishaps and discuss how we can use our collective resources to everyone's advantage. Right now plans are being laid for a community garden to be set up on some of my unused land. The situation seems grim, for now, but my neighbors have really come together.

The puppet masters particularly celebrate this theme both throughout the game and toward its end. The following quotation, from puppet master *Bodi (Designer)* is an example:

We have this brilliance in our midst and maybe World Without Oil has got some way to empowering it. Including the voice in each of us that did not know how to begin speaking. We've been together for almost 9 months. So, what did we really just [?] and give birth to? ... that phone call made me realize that we've lived through something that defines us, that we cannot just walk away from. We are woven into each other's stories, and we resonate like harp strings into our collective future.[12]

The theme of community is particularly pronounced in later posts as players reflect on their experience of playing the game.

DISCUSSION

In this section, we go back to our research questions, specifically how the qualitative analysis of participation patterns begins to address the question: *What are the kinds of engagement are fostered in these environments and are these engagements generative of collective intelligence and innovative problem solving?* To do so, we first outline three main issues that are highlighted by the qualitative and quantitative analysis, namely the imbalance of participation profiles; the narrow framing of the problem; and limited guidance and emphasis on credibility of information. Based on these issues we discuss the challenge of groupthink specifically as it appears in WWO.

Imbalance of Participation Profiles

The five profiles outlined in the quantitative analysis, plus the 14 game designers who submitted content during the simulation, account for 93.6% of active contributors. High attrition rates, and the large percent of one-time contributors (170 of 331 active participants) suggest that the designers of the game might have planned the participation structures to better engage players over the long term.

At the most basic level we see a high drop in participation after the first few days raising the question of how varied mechanisms such as diverse storylines, feedback, or varied kinds of content may be used to sustain participation. For example, an important element in maintaining player interest in games is feedback. Ipsatic feedback (how you are doing relative to your own prior play) and normative feedback (how you are doing relative to all players) permit participants a richer understanding of the game and how their contributions construct the game narrative [28] Real-time feedback during the game, such as personalized reminders, return prompts, or other tools commonly employed by commercial sites and social networks to increase and sustain user engagement may also be used productively to sustain interest and engagement in the game.

The participation profiles outlined in the quantitative section enable a more detailed assessment of participation in WWO than has previously been possible. They also serve as an analytical tool to guide thinking about meaningful engagements in self-organizing collaborative environments. For example, we might consider the presence and contribution of "toe dippers" and "drop-outs" in the overall success of the game. These players are able to enter the space because of the low barrier to participation and no commitment requirements. Ease of entry to the game is arguably important for inviting people to try a novel experience; furthermore it helps create the excitement and sense of collective mission that is key to building momentum. At the same time, the initial high response rate may mislead more committed players and puppet masters regarding the game's overall success.

The hyper-engaged players pose a different but related challenge. These players' engagement and participation is important to the success of the game, as their frequent contributions keep the narrative fresh and moving. At the same time the intensity of their participation might dominate the flow and direction of the narrative at the expense of marginal voices. This goes against one of the central concepts of the ARG: their ability to bring together players with diverse backgrounds and experiences, thus enabling the entire player community to learn. Analysis of Wikipedia

[11] http://degausser618.livejournal.com/929.html

[12] http://dessum9.dl.hipcast.com/deluge/f8121e71-02df-81f4-086d-04b78d6dee62.mp3

contribution patterns have identified similar challenges: the contributions of less-frequent editors may be stifled by more regular users, those who set the norms of participation [21].

Future ARGs might employ the profiles developed from this exploration to balance the number of "toe dippers" and "drop-outs", increasing long-term engagement, and improving the likelihood of fostering learning from the game experience. While the algorithmic nature of the profiles may change to suit a particular game experience, the five profiles we propose can serve as patterns off of which participation designers can craft better game mechanics.

Problem Framing

In reading the contributions to World Without Oil, we were struck by the degree to which gasoline availability was a central focus of the narrative across all participant profiles. The game's daily update to the price of gasoline, positioned prominently in the upper left of the website layout during the simulation, was more than just a gentle reminder that fuel consumption is an important component of our sustainability discourse. It appears to have framed oil issues specifically in terms of oil consumption for transportation, both of people and material goods, even though this is only one of the areas where petroleum shortage would affect daily life. Other areas where petroleum directly or indirectly affects everyday activities, from the creation of plastics and petrochemicals, defense, or infrastructural uses of gasoline in public transit are less salient themes when they are touched upon at all. Strikingly absent from the discourse is a discussion of social justice and concern for those in the majority world, where an oil crisis might have a more significant impact not just on comforts like the single-occupancy vehicle, but on economic and physical survival.

Credibility and Guidance

In spite of the close connection established with reality, and the goal of the game to develop "firsthand insights," about a possible crisis and "a record of a real peak-oil scenario might play out," there are no mechanisms in the game to check the credibility of information and effectiveness of proposed changes, or evaluate the plausibility of the imagined scenarios.

The inability to distinguish factual and fictional information is further complicated by the subjective nature of feedback from the game. For example, a post about energy being a finite resource, citing data from the U.S. Energy Information Administration[13], and an amateur music video titled, "I choose to be positive," (submitted by one of the puppet masters) are both among the top posts on in their respective weeks.

Voices of knowledgeable individuals from environmental science, policy, or other related topics who can help players to see different sides of the issues and reason about the soundness and effectiveness of their proposals are missing. Similarly, the voices of experts who can help participants in their imagination of what the situation might entail (such as those who have first-hand experience of a similar situation) are not included [7]. There is no measure or attempt to check the imagined scenarios and actions against facts or actual scenarios.

There is little discussion of how the proposals might take hold in actuality considering the economic, political and cultural complexities and interdependences in a real world system.

For example, player *nitefoll (Drop-out)* rightly questions the practicality of his/her "crazy idea" of a community kitchen where people donate anything they can and in return they get a nutritious meal.

"*Not sure about the long term ramifications/practicalities but people boarding themselves in their homes surviving on tinned beans is not the way to go. If nothing else for the prevention of malnutrition and health risks doing this causes."*[14]

However, this question is not engaged and the entry is largely praised for being community-oriented by the puppet masters. In summary, while the game claims to simulate 'reality' there is no mechanism that would enable its participants to check it against reality.

The absence of outside perspectives, or other sources to encourage, support, or bring in critical points of view, together with the overall emphasis on members to adopt "positive" responses, can inadvertently undermine this diversity, motivating the members to conform.

The qualitative analysis thus highlights the challenges creating an environment that is cooperative and cultivates critical and creative engagement with issues at the same time. Based on our analyses, the design of the game creates a flexible space enabling participants to easily communicate and exchange ideas. The mechanics of the game, such as the challenges and rewards set by the designers, succeed in getting the participants to actively and imaginatively engage with the thought-experiment. This active engagement with the game and other participants creates a sense of commitment and accomplishment that manifests in players' reflections on the game.

At the same time, our sampling of players' responses indicates that while player contributions are colorful and imaginative in their details, the recurring themes (of disruption; micro-sustainability; scenarios of chaos; and scenarios of hope) are predictable and trite. These themes

[13] http://ourfiniteworld.com/2007/04/22/our-world-is-finite-is-this-a-problem

[14] http://wayback.archive-it.org/690/20070511045900/http:/nitefoll.livejournal.com/5366.html

broadly follow the arc of the narrative as put forward by the puppet masters in their daily updates that appear on the homepage of the game on each day.

Collective Intelligence or Groupthink

In our view, World Without Oil undermines diversity by reducing all entries to equally valid contributions and perspectives. This concern is closely related to concerns about the general inability of (young) people to assess or "read" games similar to texts that structure information with their own "aesthetic norms, genre conventions, ideological biases, and codes of representation" [13, p.15]. In his study of youth, media and learning, Henry Jenkins identifies this as a *transparency problem,* among the three main challenges for young people to effectively use and participate in media consumption and production. He defines the transparency problem as "the challenges young people face in learning to see clearly the ways that media shape perceptions of the world" [13, p. 15]. In the context of WWO, references to reality and supporting material such as factual data, real-life events, news, and stories complicate the scenario, making it more difficult for participants to distinguish the reality constructed by the game–and lived experience. Moreover, players do not question or critique the framework of the game itself or the challenges and scenarios set by the designers.

In summary, the theme of reality is an important aspect of WWO. However, there are no means available to the players or viewers to evaluate factual data, effectiveness of the proposals for change, or contrast the imagined scenarios against lived experience. Fiction, facts, and opinions are all woven together; creating a world that appears to be real but is distant from real world correlates.

In its emphasis to encourage diverse points of view, WWO relies upon a considerable degree of subjective involvement. Thus, the nature of individual contributions and the overall tone and substance of the collective depends on the experience and expertise of its participants, and their willingness and ability to engage with the issues critically. All actions and proposals for change are considered equally valid contributions to the "collective intelligence."

World Without Oil seeks to overcome the limitations of hierarchical structures and the rigidity and political nature of traditional organizations, replacing it with a non-hierarchical ad-hoc system for sharing knowledge and learning. In doing so it downplays the role and power of the game's structure, and the fact that stories that are added or highlighted by the designers in steering the direction of the game. Moreover, in its emphasis on openness, inclusiveness and a positive atmosphere, it (unintentionally) plays down reflection and resistance that are important modes of participation and real world problem solving.

CONCLUSION

Based on our discussion, we draw out the following design implications for ARGs that seek to cultivate diversity and engage players in creative problem solving. Foremost, it is important to give careful attention to problem framing and seed scenarios that guide players' responses and development of the narrative. It is also crucial to design feedback mechanisms that guide players and viewers in judging and evaluating the responses enabling them to parse out facts from fiction, and plausible scenarios and solutions from problematic or ineffective ones. To do so, ARGs that aim to cultivate diversity and creative problem solving need to involve puppet masters with subject matter expertise who can better guide the narrative and engage players toward scenarios that are both imaginative and plausible. Lastly, it such spaces should be more transparent about their limitations by acknowledging how their design and development are intertwined with the discourse that emerges within them so players can better judge and "read" the resulting narrative.

WWO provided a novel interactive space for people to engage with problems of genuine social import. While ARGs and other collective, narrative problem solving spaces hold tremendous potential for addressing these problems, they are not without their challenges. Designers of these spaces should be cognizant of different participant profiles, and how these patterns of contribution affect the flow of the game. Subsequent learning or anticipated individual behavior change is predicated on both the quantity and character of engagement with the problem space and other participants. Our approach to understanding ARGs such as WWO, using a reconstructed "searchable" game narrative and content analysis, provides unique "post mortem" insights that contribute to our assessment of the game's overall effects. It also serves as a pattern that might be replicated with other ARGs to further analyze learning outcomes. To be effective learning spaces, ARGs much provide feedback that facilitates richer modes of interaction, as well as game mechanics that promote diverse communities and reflection on a range of possible solutions. Our analysis suggests that WWO was too tightly scripted to the designers' own solutions and philosophy; the result is a flat conversation with little innovation and almost no productive dissent. As funding agencies such as the National Science Foundation have promoted the design of ARGs to facilitate learning, we can and should do much more to assess their validity and impact before, during and after the game, beyond anecdotal evidence from designers and puppet masters.

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