

**Why I Love Bees:  
A Case Study in Collective Intelligence Gaming**

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*How can people and computers be connected so that—collectively—they act more intelligently than any individuals, groups, or computers have ever done before?*

—Thomas W. Malone, Director, MIT Center for Collective Intelligence<sup>1</sup>

*We experienced being part of a collective intelligence... participating in a search for, or perhaps creation of, a greater, shared meaning.*

—Phaedra, *I Love Bees* player<sup>2</sup>

Can a computer game teach collective intelligence?

The term ‘collective intelligence’, or CI for short, was originally coined by French philosopher Pierre Levy in 1994 to describe the impact of Internet technologies on the cultural production and consumption of knowledge. Levy argued that because the Internet facilitates a rapid, open and global exchange of data and ideas, over time the network should “mobilize and coordinate the intelligence, experience, skills, wisdom, and imagination of humanity” in new and unexpected ways.<sup>3</sup> As part of his utopian vision for a more collaborative knowledge culture, he predicted: “We are passing from the Cartesian *cogito*”—I think, therefore I am—“to *cogitamus*”—we think, therefore we are.<sup>4</sup>

The result of this new “we”, Levy argued, would be a more complex, flexible and dynamic knowledge base. In a CI culture, he wrote, knowledge “ceases to be the object of established fact and becomes a project.”<sup>5</sup> Members of a collective intelligence would not simply gather, master and deploy pre-existing information and concepts. Instead, they would work with the collected facts and viewpoints to actively author, discover and invent new, computer-fueled ways of thinking, strategizing, and coordinating.

Whereas Levy was making predictions about a collaborative culture to come, real-world examples of early forms of collective intelligence today proliferate. Perhaps the most well-known CI experiment is Wikipedia, the free online encyclopedia written and edited by the public, using the collaborative writing software known as a Wiki.<sup>6</sup> Yahoo! Answers allows users to pose any question, on any topic, to the online public; amateurs and experts alike offer their best answers, which are rated by other users so that those deemed most helpful or insightful rise to the top.<sup>7</sup> Google Image Labeler, originally developed by Carnegie Mellon University researchers as the ESP Game, invites the public to improve its image search engine by working collaboratively to categorize online pictures by agreeing on specific, descriptive tags.<sup>8</sup> MapHub enables users to upload personal stories and experiences of specific geographic locations to online maps, so that they become rich with site-specific data that paints a picture of collective experience.<sup>9</sup> SFZero, an online role-playing game, describes itself as a “collaborative productive game”, relying on its players to generate and to score virtually all of its missions.<sup>10</sup> And multiple online prediction markets, from the Hollywood Stock Exchange to the World Economic Forum’s Global Risks Prediction Market, allow individuals to wager on the likelihood of future events, from entertainment awards to terrorist attacks—typically with a startling degree of success.<sup>11</sup>

What do these myriad CI projects share in common? They all use digital networks to connect *massively-multi* human users in a persistent process of social data-gathering, analysis and application. Their goal: to produce a kind of collectively-generated knowledge that is different not just quantitatively, but also *qualitatively*, in both its formation and its uses.

As more and more popular examples of collective intelligence have emerged, institutional interest in understanding and cultivating CI has grown steadily. Most notably, in the fall of 2006, the Massachusetts Institute of Technology (MIT) launched a dedicated Center for Collective

Intelligence. The center, which brings together faculty from the fields of computer science, artificial intelligence, cognitive psychology, business management, and the digital media arts, describes its central research problem as this: “How can people and computers be connected so that—collectively—they act more intelligently than any individuals, groups, or computers have ever done before?”<sup>12</sup> According to Professor Thomas J. Malone, director of the center, the stakes of this question are high. “New technologies are now making it possible to organize groups in very new ways, in ways that have never been possible before in the history of humanity.... better ways to organize businesses, to conduct science, to run governments, and--perhaps most importantly--to help solve the problems we face as society and as a planet.”<sup>13</sup>

To explore these possibilities, cutting-edge CI research at MIT and elsewhere is just now beginning to generate theories about what kind of interactive design and technological infrastructure will be necessary for a collective intelligence to emerge consistently from the global digital network.<sup>i</sup> But while the design and development of digital systems that support collective intelligence is a significant problem that deserves our immediate attention, it is not the only major challenge that faces proponents of a more open and participatory knowledge culture. There is no guarantee that everyone with access to computer network technologies will be automatically absorbed into this culture of collective intelligence. Indeed, in *Convergence Culture*, media theorist Henry Jenkins reminds us that as we embark on an age of powerful,

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<sup>i</sup> Seminal work in this emerging space of collective intelligence design includes James Surowiecki’s *The Wisdom of Crowds* (New York: Doubleday, 2004), which identifies diversity, independence, and decentralization of participants as the three fundamental requirements to produce CI, and Howard Bloom’s *Global Brain* (New York: Wiley, 2000), which argues for a strategic balance of conformity and diversity among CI participants, along with core interactive mechanics that allow participants to internally evaluate and revise strategies, to re-allocate resources, and to compete externally with other CI groups.

networked collaboration, “We are just learning how to exercise that power—individually and collectively—and fighting to define the terms under which we will be allowed to participate.”<sup>14</sup>

Once CI systems are in place, how do we ensure widespread entry for today’s youth into the collective? To engage as many and as diverse young people as possible in the new knowledge network, specific CI skills, such as the ability to parse complicated problems into distinct parts and a facility for real-time virtual coordination, will need to be taught. Indeed, as CI increasingly becomes a vital component of our social, political and creative lives, it seems ever more likely that our formal education system will need to include both instruction and practice in how to construct and contribute to a collective intelligence. A CI curriculum would provide students with the opportunity to develop a new kind of digital network literacy, one specifically tuned to the techniques, challenges and rewards of massively-scaled collaboration.

In *Rainbows End*, award-winning science fiction author Vernor Vinge gives us a tantalizing glimpse of what such a CI curriculum might look like in the near future. Set in the year 2025, Vinge’s novel describes a world in which globally distributed, inter-generational teams of amateurs and experts collaborate by the thousands, the hundreds of thousands, and even the millions, to make political decisions, to solve mysteries, to create art, and to predict and forestall health pandemics, terrorist attacks, and economic crises. Acknowledging that myriad forms of collective network participation already are beginning to occur across a wide swath of emergent technological cultures, Vinge subtitles his book: “A novel with one foot in the future”—implying that the foundation for its fiction is already being laid by CI experiments in the present. But Vinge is interested in outlining the possibilities for a more formal foundation. In his novel, young students are prepared to be effective CI members through rigorous in-class instruction. Specifically, Vinge’s imagined educational system requires high school students to take a course

called Search and Analysis, in which they learn both practical technology skills and social strategies for how to participate in a collective intelligence network.

Vinge dedicates only a couple of pages to describing this fictional class; it serves primarily as texture for his science fiction landscape. But the following passage stands out as a provocative illustration of how collective intelligence might be taught and inspired in young students:

“I have a theory of life,” said [the teacher] Chumlig, “and it is straight out of gaming: *There is always an angle.* You, each of you, have some special wild cards. Play with them. Find out what makes you different and better. Because it is there, if only you can find it. And once you do, you’ll be able to contribute answers to others and others will be willing to contribute back to you. In short, synthetic serendipity doesn’t just happen. By golly, you must create it.”<sup>15</sup>

The fictional students are informed that they will have to take an active role in securing a place for themselves in the collective intelligence. Individual relevance and participation in a CI culture is not guaranteed, the teacher Chumlig insists, and therefore each student must cultivate unique interests, talents, and core knowledge sets. As Levy observed in his early treatise on *Collective Intelligence*: “No one knows everything, everyone knows something”<sup>16</sup>. Vinge’s futuristic class therefore offers the students *differentiation* as a practical strategy for developing individual relevance and power in a CI culture. Specialized, distinctive capabilities and resources will later serve as their personal currency in the intelligence market.

Perhaps more important than these practical strategies, though, are the social and psychological aspects to Vinge’s fictional course work. Levy’s original treatise on collective intelligence stressed that the individual thinker must not be lost in this new and more powerful “we.” To the contrary, Levy wrote, “The basis and goal of collective intelligence is the mutual

recognition and enrichment of *individuals*.”<sup>17</sup> And so, by promising that there is something that makes each student “different and better”, Chumlig encourages her students to be secure in their individual identity. She urges them not to be overwhelmed by the daunting size of the CI community, or made to feel insignificant by the seemingly infinite scope of its efforts. Instead, she prepares each student to see him or herself as playing a singular, meaningful role in the network, with valuable individual micro-contributions to make to the massively-scaled effort.

Vinge’s fictional teacher offers her year-2025 advice by talking metaphorically about the culture of collective intelligence as a kind of game. But in our present-day society, real “search and analysis” computer games are already taking up the task of teaching young people a basic literacy in collective intelligence. How can massively-multiplayer games function as immersive tutorials in network collaboration and coordination? This case study is an exploration of one such game.

### **The Rise of Collective Intelligence in Digital Gaming Culture**

In the summer of 2004, the commercial game design company 42 Entertainment launched *I Love Bees*, a Web-based interactive fiction that used websites, blogs, emails, jpegs, Mp3 recordings, and other digital artifacts to create an immersive back-story for Microsoft’s sci-fi shooter videogame *Halo 2*. I was the lead community designer of *I Love Bees*, and in this role, my primarily responsibility was to oversee the emerging collective intelligence of its players. In this case study, I will explore the design and deployment of *I Love Bees* as an experiment in constructing a game-based digital learning environment, in which players can experience firsthand in a low-risk setting the challenges and pleasures of becoming part of a massively-collaborative knowledge network.

The distributed fiction of *I Love Bees* was designed as a kind of investigative playground, in which players could collect, assemble and interpret thousands of different story pieces related to the *Halo* universe. By reconstructing and making sense of the fragmented fiction, the fans would collaboratively author a narrative bridge between the first *Halo* videogame and its sequel. As the project's lead writer Sean Stewart explains: "Instead of telling a story, we would present the evidence of that story, and let the players tell it to themselves."<sup>18</sup>

At the outset of *I Love Bees*, however, we explained none of this to the players. We kept secret the project's intentions to serve as an interactive back-story, and we did not disclose the search and analysis mechanics we had designed. In fact, we never officially announced the launch of a new *Halo*-related online game—instead, we simply hid the game in plain sight on the World Wide Web. We hoped the mystery would generate buzz about the project. And by requiring the players to discover the existence, secret purpose and patterns of the game themselves, we also took the first step toward gaining the players' constructive participation in the project. The only clue we gave that a strange, new game was afoot came in the form of an unassuming url, which flickered briefly across the screen in the final frames of a theatrical trailer for *Halo 2*. The hidden url pointed sharp-eyed viewers to [www.ilovebees.com](http://www.ilovebees.com), the real, working website of a fictional character—an amateur beekeeper named Margaret, who seemed completely unrelated to the *Halo* mythology. As *Halo* fans wondered what on Earth beekeeping had to do with *Halo*'s futuristic alien wars, they were drawn into a mystery: *I Love Bees* clearly was no ordinary website. It had been hacked, and its webmaster desperately needed help figuring out why—and what to do about it.

The hacked home page blasted visitors with cryptic warnings of "system peril" and "network throttling."<sup>19</sup> It promised: "This medium will metastasize" and displayed an ominous looking

timer marked “Countdown to Wide Awake and Physical.” Players quickly performed calculations and realized that the timer was counting down the hours, minutes and seconds to a specific date four weeks in the future: August 24, 2004. They immediately began a massively-multiplayer investigation: What would happen on August 24?

The players soon discovered another clue: on the same website, the hacker had replaced the beekeepers’ favorite honey-based recipes with 210 unique pairs of Global Positioning System (GPS) coordinates. Each of pair of coordinates—such as a latitude of 38.891883 and a longitude of -077.026117—appeared directly above a matching time code—such as 06:07 PDT.<sup>20</sup> The 210 time codes were precisely spaced apart three or four minutes each, so that they stretched across a 12-hour period: from sunrise to sundown in the Pacific Daylight Savings Time zone. A smaller countdown on the recipe page, marked “Axons Go Hot”, was counting down to the same date as the homepage.

Amidst all of this confounding content, a single FAQ at the bottom of the hacked homepage posed an explicit opening challenge to the *Halo* fans: “Q: What happened to this site? A: Help me find out [here](#).” Players who clicked on the Web link “here” found the blog of a young woman named Dana, the beekeeper’s niece and website administrator, who was soliciting the public’s help with fixing [www.ilovebees.com](http://www.ilovebees.com). But in a frantic post titled “emergency exit”, Dana told players that she was contemplating going into hiding.<sup>21</sup> Indeed, after exchanging nearly one hundred personal emails with the players, she disappeared, leaving them to deal with the countdown and its looming threats on their own.

The players received no further instructions. The *I Love Bees* game did not articulate a specific goal, a win condition, rules, or any of the other formal guidelines traditionally associated with games. Nor did it offer any obvious choices to make, or sequences of buttons to press, or



virtual objects to collect. Instead, the players had only a call to action, a very complex data set, a few seemingly random threads of story—and the freedom to respond to them however they wanted. In the end, this single core mystery of the hacker and its GPS coordinates took more than 600,000 collaborating players—largely high school and college students—nearly four months to solve.<sup>ii</sup>

42 Entertainment’s main goal in producing the project as a commercial game was, of course, exciting entertainment through immersive storytelling. But, we also built *I Love Bees* as a tutorial in collective intelligence. Elan Lee, the director of *I Love Bees*, has famously described the core mandate of his game design philosophy: “To create puzzles and challenges that no single person could solve on their own.”<sup>22</sup> And in a post-game online chat with *I Love Bees* players, lead writer Sean Stewart wrote: “The game isn't the art, or the puzzles, or the story. They are designed to precipitate, to catalyze the actual work of art. Which is you.”<sup>23</sup> In other words, the massively collaborative, search and analysis gameplay of *I Love Bees* was a means to an end beyond innovative entertainment. It sought to create a highly connected player-base dedicated to, and impressively capable of, defining and solving large-scale problems together. Lee and Stewart describe the players of 42 Entertainment games as “a collective intelligence that is unparalleled in entertainment history.”<sup>24</sup>

Why create a collective intelligence around the *Halo* videogame series? Digital gaming culture is already moving swiftly in the direction of networked collaboration. *Halo 2*,

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<sup>ii</sup> Because players are not required to register any personal details in order to play a game like *I Love Bees*, obtaining precise demographic data is extremely difficult. As the primary community researcher for the game, however, I estimate that approximately twenty per cent of players were eighteen years old or younger, while another half were under the age of twenty-five. My rough demographic estimates here are based on an analysis of personal details mentioned by players on *I Love Bees* forums and in emails written to game characters; profile information on player-created blogs and forums; and my direct observation of player ages at live events. The number 600,000 is derived from proprietary Web traffic data and statistics collected by 42 Entertainment.

specifically, was produced by Microsoft Game Studios (MGS) for Xbox Live, an online service enabling players worldwide to connect their Xbox consoles to a global gameplay network. To this end, MGS designed *Halo 2* as a highly and unusually collaborative videogame experience. It described the game's innovative "cooperative play mode" in promotional materials: "New technology lets groups of friends stick together... Team up with a friend and save humankind together."<sup>25</sup> *I Love Bees* presented this same challenge on a more ambitious scale. By extending the platform of play into the entire ubiquitous computing network, the cooperative sixteen-player *Halo* networks enabled by Xbox Live became a massively collaborative *Halo* network.

In this case study, I explore the three stages of *I Love Bees* gameplay that ultimately produced a game-based CI. They are: 1) *collective cognition*, 2) *cooperation*, and 3) *coordination*. These three stages encompass, respectively, the initial formation of community, the development of distributed skill sets, and the scaffolding of group challenge that are essential elements of both massively-multiplayer game systems and the new CI knowledge networks. I also identify the three aspects of *I Love Bees*' game design that resulted in these distinct stages of highly collaborative gameplay: 1) *massively distributed content*, 2) *meaningful ambiguity*, and 3) *real-time responsiveness*. I offer these elements as a reproducible set of core design requirements that may be used to inspire future learning systems that support and ultimately bring to a satisfying conclusion a firsthand engagement with collective intelligence.

### **Stage One: Reconstructing a Hive Mind**

The players of *I Love Bees* faced a single, open-ended challenge: "What happened to this site? Help me out here." To formulate a thoughtful response, the players first needed to understand the fictional world in which the game was being played. To do so meant putting together a story that had been shattered into thousands of pieces. This is the gameplay stage I call *collective*

*cognition*. During this stage, players collected, compiled, and analyzed game content, developing a cohesive theory of the game world and a shared language for discussing it. This initial period of intense collaboration provided the players with a sense of community, shared focus, and common knowledge. These social learning gains would later provide context and support for resolving more complex interpretive conflicts, and for coordinating increasingly challenging parallel efforts.

The distributed narrative of *I Love Bees* played out in highly “deconstructed” form. It was revealed in clue-sized pieces over the course of four months across hundreds of web pages, dozens of blog posts, thousands of emails, and over 40,000 live Mp3 transmissions. Some of these content fragments could be found by anyone who looked closely enough. Others loaded only on the Web browsers of players logging in from IP addresses linked to specific geographic regions. Still others were sent as private, personalized emails or phone calls to a single player out of the hundreds of thousands of total players. Because of this massive distribution of content, responsibility rested on each and every player to come forward with any and all discoveries, so that the entire collective could access and process as complete a data set as possible. As one *I Love Bees* player remarked during the game: "This is really beautiful. In order for any of us to move forward WE ALL have to move forward."<sup>26</sup>

These massively-distributed puzzle pieces were tracked down and documented by individuals, but compiled and analyzed by the group. Once a new piece of content was turned over to the collective, it then would be analyzed by thousands of players on dozens of different community forums. A single new clue detected on Dana’s blog, for example, resulted in 2401 new comments from players within days of being found.<sup>27</sup> On one of the primary Internet Relay Channels used for *I Love Bees* speculation, players logged an average of 33,000 lines of chat daily discussing

the story.<sup>28</sup> One particularly popular message board for *Halo* fans working on the *I Love Bees* mystery clocked in at a mind-boggling fifty new posts every thirty seconds during the first week of clue-gathering.<sup>29</sup> Several other host servers were temporarily shut-down and massively upgraded to handle the rapid exchange of facts, theories and speculation.<sup>30</sup> In total, in the first ten weeks of gameplay, players who had sub-divided into core discussion groups of several hundred or thousand players each produced over a million message board posts in the quest to compile and dissect the narrative evidence.<sup>31</sup> The players' production of written analysis of *I Love Bees* content was nothing short of prolific. More importantly, each individual could be assured of a massive audience for their contributions. The first *I Love Bees* player-created story wiki, for example, received 1,157,951 page views in the first two weeks.<sup>32</sup>

In addition to the traditional online communications platforms of forums, blogs, Internet Relay Channels, and personal websites, the players also used a range of online collaboration tools to compile and discuss the distributed content: Wikis, group-moderated blogs and multi-authored mailing lists, collaborative spreadsheets to list-servs, and toll-free online teleconferencing systems, to name just a few. These networked platforms enabled individuals to instantly update the entire player base with found data and novel interpretations. At the same time, by engaging these platforms, players generated a personal fluency in important emerging technologies. Playing the game meant flexing their muscles as literate users of this complex, participatory information space.

What did the players finally discover, after all of this narrative search and analysis? When put together, the story clues presented a series of dramatic events leading up to the opening scene of *Halo 2*, when a race of hostile aliens land on Earth. The extremely complicated narrative premise developed by Stewart is summarized best by the players' collectively authored wiki-based

“walkthrough guide” to the game. This wiki tracks players’ understanding of the story over time. For instance, after gathering and sorting through the first weeks’ worth of hundreds of pieces of narrative clues hidden on [www.ilovebees.com](http://www.ilovebees.com) and in emails, the player community tentatively posted a collectively-authored interpretation of over 500 of those fragments on a wiki. The fragments were broken bits of poems, such as *MAYDAY MAYDAY MAYDAY It happened one day, about noon, going towards my boat, I was exceedingly surprised with the print of a flea's naked foot on the shore, which was very plain to be seen on the sand.* The summary also addressed over 150 found lines of futuristic programming code found scattered around the pages of [www.ilovebees.com](http://www.ilovebees.com), such as *grope: !probe extern proc 0 crypt strong.* The players tentatively surmised:

MAYDAY TEXT: we can collect all the maroon text into one coherent narrative, written by someone (or something) nicknamed The Operator. The Operator is lost, away from home, and has been shipwrecked - hence the Mayday....

COMPUTER CODE: we have no way of knowing if we've put all the fragments in the right order yet, but looking at the code seems to give us some clues. We can see that something is broken, but most of it is meaningless at the moment.<sup>33</sup>

Later, as they gathered more pieces and conducted more analysis, the players’ evolved their understanding, until they concluded that the following passage best described the game’s plot:

A military spacecraft named the Apocalypso from the *Halo* universe has crashed, and somehow it’s controlling A.I. [artificial intelligence] has ended up on Earth. The A.I. controlling the craft, named Melissa (informally known as The Operator by her crew)... was very badly damaged and spent a while in delirium, not knowing where it is. The Operator apparently managed to transfer itself to a

computer in the Bay Area. It then took over a beekeeping website, [ilovebees.com](http://ilovebees.com), from which the Operator is trying to signal any survivors from the crew on the planet.<sup>34</sup>

As this summary shows, the players concluded that the psychotic “hacker” was in fact a damaged AI program that had taken over an amateur beekeeper’s website and was leaking memories and code onto the otherwise ordinary web pages in an attempt to put itself back into working order.

But why would a *Halo* A.I. land on a beekeepers’ website? What did bees have to do with the fictional world of *Halo*, players wondered, in which a future alien race attempts to annihilate humanity with outrageously powerful weapons? The answer, as players came to realize through their collective analysis, is nothing. Bees were chosen as a plot point by *I Love Bees*’ creators not because of a natural connection to the existing gameworld, but rather to evoke the game’s collective intelligence goals.

In a 2001 essay “The Cyberspace Dialectic”, digital theorist Michael Heim described proponents of collective intelligence as “network idealists”. He wrote: “The network idealist builds collective beehives. The idealist sees the next century as an enormous communitarian buzz.”<sup>35</sup> In the *I Love Bees* plot, we find a literal representation of what Heim identifies as the network idealists’ ardent desire to see “the worldwide networks that cover the planet from a global beehive.”<sup>36</sup> When Lee first explained the project to me in April 2004, he acknowledged that the metaphor implied by “[www.ilovebees.com](http://www.ilovebees.com)” was intentional. “It absolutely was meant to make players think about themselves as a hive mind.”<sup>37</sup>

The players quickly picked up on this gesture toward collaborative gaming, demonstrating a general awareness of the concepts of hive minds and collective intelligence. An early post read: “I think one of the reasons ‘The Operator’ chose to invade a site about bees was to contact us....

It needed a hive intellect, or as we'd call it, a collective detective.”<sup>38</sup> Another player suggested: “I think that this won't be an entire game about bees... but the hive mind or collective mind comparison may prove to be intentional.”<sup>39</sup> Indeed, the players showed a conscious awareness of the designers' use of metaphor to shape the community. One player wrote: “The creators of this... have definitely put some thought into the storyline, and they definitely consider us SOMETHING. I wouldn't be surprised if we ARE supposed to be the bees.”<sup>40</sup> As they discussed what to call themselves, the players embraced the bee-inspired metaphor: “I'd call us The Hive or HiveMind... after all, we are a collective.”<sup>41</sup> The community excitedly embraced the metaphor. One player wrote simply: “Dude, that means that WE are the bees!”<sup>42</sup>

Not all players were familiar with these concepts, however, and so some individuals took the lead in explaining them. One player attempted to explain all of the hive mind references: “You know how an individual bee isn't too intelligent, but the entire hive acting as a whole can display a remarkable cohesiveness -- becoming more than the sum of its parts, so to speak? And you know how an individual silicon computer chip can't do a darn thing, but if you put enough of them together in the right way, whoa, you get the Internet?”<sup>43</sup>

Through its rather conspicuous allusions to a hive mind, *I Love Bees* encouraged players to develop self-awareness. It not only inspired collectively intelligent behavior, but also gave the players a language for talking about CI. Developing fluency with the concept and terminology of CI therefore was an important part of the overall story design. It enabled what literacy theorist James Paul Gee calls “meta-level reflection” about the learning that was taking place.<sup>44</sup>

The “axons go hot” clue, which appeared above the list of GPS coordinates and time codes, is an excellent example of how a language of CI was embedded in the content of *I Love Bees*, in order to facilitate meta-level reflection. Early on in the game, many players on different forums

linked to the Wikipedia entry for “axon” as part of their effort to unpack the phrase. Their most widely circulated reference was the following definition obtained from that entry: “An axon, or nerve fiber, is a long slender projection of a nerve cell, or neuron, that conducts electrical impulses away from the neuron's cell body or soma. Axons are in effect the primary transmission lines of the nervous system.”<sup>45</sup> For weeks, players considered what this message meant literally and metaphorically, until one player suggested an interpretation that spread very quickly and gained widespread acceptance across the player community. He wrote: “The countdown phrase ‘Axons go hot’ in relation to an AI would put one immediately in mind of a *neural net*. Could this be a neural net that Melissa is building?”<sup>46</sup> This insight resonated strongly with the narrative puzzle the players had already solved: that Melissa was a broken AI, attempting to repair itself.

The players thus came to consensus that the GPS coordinates were silicon axons, part of an AI’s effort to build a neural net using a ubiquitous computing infrastructure. The actual structure of a brain, of course, is an important metaphorical tool for thinking and talking about collective intelligence. As Thomas J. Malone observes: “Collective intelligence has existed for a very long time... we could even view a single human brain as a collection of individual neurons or parts of the brain that collectively act intelligently.”<sup>47</sup> In this way, the Operator’s in-fiction efforts to create a neural net paralleled (and therefore served as a conceptual model for) the players’ own construction of a CI network. Like a Russian doll, the theme of collective intelligence in *I Love Bees* nested inside itself: an artificial intelligence program rebuilds itself, axons go hot, players form the hive mind.

And so it was through the narrative context of CI constructs that players confronted the central puzzle of the game: What should they do about the axons? Now that they had created a



shared context for action, what was the appropriate collective response to the GPS coordinates, time codes and countdown?

### **Stage Two: Making Meaning**

When the 210 pairs of GPS coordinates were first discovered, there was no consensus among players regarding what to do with them. Even after the players agreed on a narrative context, the 210 points of data represented a highly ambiguous call to action. Their efforts to work together to explore this ambiguity marked the second phase of CI gameplay. I call it the *cooperation* stage. In this stage, players individually formulated hypotheses, presented them to the group, and then solicited help in collaboratively testing and refining them.

During the course of *I Love Bees*, the GPS coordinates page was visited by nearly a million different users, and discussed by hundreds of thousands of players on many dozens of forums. Here, I want to focus on the GPS puzzle-solving work of just one particularly well-organized group of approximately 4,000 players, who called themselves the Beekeepers. Their efforts to solve this problem, and the 2850 forum posts they collectively scribed to keep track of these efforts, were followed closely and referenced frequently by the majority of other player forums.<sup>48</sup> As such, their work serves as an excellent microcosm of the larger, sometimes seemingly chaotic, cooperative speculation and data processing that took place during the weeks leading up to the end of the “Axons go hot” countdown on August 24, 2004.

At first, the number of plausible strategies for processing the GPS data proposed by the Beekeepers seemed infinite. Some thought that the coordinates were a code for a verbal message. A player using the handle Nightmare Tony wrote: “What if the coordinates are merely giving us letters, such as the first names of each city or town, and THAT is the actual code phrase?”<sup>49</sup> K proposed instead: “I thought the time gap between the coordinates might be to do with Morse

code—the three minute gaps correspond to a dot, and the four minute gaps correspond to a dash. Not sure how you'd separate letters, though.”<sup>50</sup>

Others suggested that plotting the coordinates would reveal the solution. Emouse wrote: “Connect the dots?”<sup>51</sup> Swissben wrote: “Do we have a way to get the actual altitude of these positions through maporama or their sites? Maybe we need to add a third dimension to these points....”<sup>52</sup> Lorre wrote: “What if we calculate the distance between the points (pairs) on a routeplanner?”<sup>53</sup>

Some thought that visiting the real-world locations would reveal more clues. A Beekeeper named Spgheddy wrote: “These GPS coordinates are very precise—down to 15 ft in each direction, which is about 10 steps in each direction. We need to go to the locations and look at things that are within this precise area.”<sup>54</sup> Many others looked for a common thread in the locations identified by the coordinates. Guest\_Beekeeper wrote: “Can these coordinates somehow be arranged into numbers of IP addresses?”<sup>55</sup> Jbd wrote: “Maybe they're Wi-Fi locations.”<sup>56</sup> BoonIsha wrote: “Radio stations? Have we checked radios broadcasting frequencies for these locations?”<sup>57</sup> John Incognito wrote: “Are there any traffic cameras at the GPS locations in the towns about cell towers?”<sup>58</sup> MrToasty wrote: “Could these possibly map to cell tower locations?”<sup>59</sup>

And yet others wondered if the GPS coordinates were posing a map-based mathematical puzzle. Nola wrote: “Can we determine a point that is equidistant to all 220 locations?”<sup>60</sup> Xyzzy wrote: “Time, time, time. Everyone's so concentrated on the points themselves that time is slipping under the rug. What is the significance of when each Axon goes live? Has there been a mathematical look at the possible patterns there?”<sup>61</sup> Will Bushman wrote: “Since this is in a large part an AI game, and has some familiar AI terminology in this puzzle, axons from neural nets,

why not treat it as an old AI problem, the traveling salesman problem. Essentially try to determine the shortest path which goes through every point, but doesn't go through any point twice.”<sup>62</sup>

As the days passed, and as individuals looked for ways to contribute ideas that hadn't already been proposed, the players began to proffer interpretive frameworks that could only be classified as highly speculative. Mayday wrote: “Not sure if it amounts to much, but I reversed all the longitudes (changed them from negative to positive) and they all fall in China. Seems a little coincidental.”<sup>63</sup> Oecumenix\_temporary wrote: “Originally I thought that maybe the new format could be used to look up biblical passages or something (like book 38, chapter 53, verse 30).”<sup>64</sup> Theorizer wrote: “These coordinates in fact aren't relative to earth, but to Space instead. So I definitely don't have the technology to check this. But if someone could check if Space has coordinates like this, and also if there are, see if they can find where they are.”<sup>65</sup>

For more than two weeks, the Beekeepers took obvious pleasure in generating progressively more creative readings of the data set. But to advance the game on August 24, they would need to take a more rigorous approach. How could they test as many of these hypotheses as possible, and narrow the interpretive field to a single collective solution before the “axons go hot” countdown hit zero?

After a flurry of several hundred wildly diverse hypotheses, the Beekeepers decided to organize into three different teams for further analysis. At this stage of meaning-making, the player group began to embody Levy's ideal of collective intelligence, which supports specialization and a recognition of diverse perspectives. Each group established a dedicated forum thread and a unique analysis mission statement. The goal of this self-differentiation: to group like-minded analysts together, allowing multiple competing threads of well-researched

interpretation to emerge. The three groups were named the “literal thread”, the “relative thread”, and the “numerical thread”. Each composed its own mission statement to clearly define its approach—and to recruit more player-analysts to its side. The first group argued:

The *literal thread* is for those who believe that we are just supposed to show up at these locations when the Axons ‘Go Hot.’ This theory has pretty much been shot down by some players since some of the locations have been found to be on private property, in front of the Sears Tower (think: a group of online dweebs gathering w/ their GPS en masse when the countdown ends... don't think the city of Chicago's gonna like that), and even one in a forest. However, I don't think this theory can be thrown out completely, as it hasn't been completely disproven.<sup>66</sup>

Another group proposed a more conceptual approach:

The *relative thread* supports the faction which believes that the coordinates are literal places, but the surrounding buildings/landmarks/streets/wifi/etc. are the key to the solution. This thread would be a good place to discuss our findings at the locations (and those at the wiki) without bothering the mathematicians.<sup>67</sup>

And the third group took a very abstract, data-crunching tact:

The *numerical thread* encompasses all those who believe the coordinates can be solved mathematically. Either by: A) disregarding that they are coordinates and using them as a series of numbers to find a hidden message, B) assuming they are coordinates, but using the locations to find new coordinates or a hidden message, C) finding a graphical representation of the coordinates which communicates a message or points to a new location.”<sup>68</sup>

Once the players had divided themselves into groups according to analytical interests and skills, they were able to get down to some serious data processing the collection of supporting evidence. They cooperatively churned through the possibilities, reporting their findings, posting helpful compilations of data, and asking for backup.

Sherpa, a player working in the numerical group, offered up a data base of preliminary calculations to the group: “In the 'scientific method' camp, here's an Excel sheet which has the co-ords, distances, pairings and addresses in it. No conclusions as yet—it's meant to be a tool to help people experiment, rather than have to dig through 30 pages and several websites to get the data. Enjoy.”<sup>69</sup> Xasper reported his own work on the database and awaited backup: “I've been playing with the sum of the digits in the postal codes as a cypher for letters, and had some weird results.... I'll watch this thread for other attempts and hopefully we can all use the information offered.”<sup>70</sup> Extrasonic did the same: “I did the calculation for the speed required to go from the first point to the second point in 4 minutes. The speed required was Mach 7 (7 times the speed of sound at sea level). .... I only calculated the speed required to go from the first coordinate (DC-area) to the second (Cleveland-area) in order to prove to myself that it wasn't feasible for something physical to make the trip (ruling out military aircraft and space-based objects). Other points might yield different, more interesting results or a pattern might emerge—I'm not trying to discourage additional investigation.”<sup>71</sup>

At the same time, the relative thread explored the potential meaning of the GPS coordinates by seeking any common thread they could find. Drizjr wrote: “I looked up my own IP on geobytes. Took the lat/long from there and pushed them through MapQuest. While it is not where I'm sitting at my computer, it matched the map from Row 103/Col 01... off by only six city blocks. To me, it's close enough to say that Melissa is tracking us down through the

emails.”<sup>72</sup> They rallied around promising theories. Handfulofhoneybees wrote: “Drizjr, I agree that a hit so close to home gives you that tingling sensation of confirmation.... but we need some data to flesh it out a bit. So once again, I implore the beekeepers! Locate yourself using any IP locator tool you can dig up on Google! Report *perfect* hits promptly, but near-perfect hits only when it seems like we've run out of options. Happy hunting.”<sup>73</sup>

The relative analysts modified the shared databases and documents generated by the numerical thread with new fields to allow for even more directions of simultaneous analysis. DanteGA wrote: “Some of the patterns have already been remarked upon: Universities, Malls/shopping centers (and don't forget the many points along 'the Mall' in Washington!), other landmarks (San Diego Zoo, airports).... what I think is more intriguing is the fact that many, many of the names of the roads share similarities. The clearest example is that many of the points are either literally on Main Street (in one case, Maine Dr, which really caught my attention), or are on the 'main' street in the town..... I am attaching a version of the coordinate spreadsheet with two columns that I've added. In the last column is my interpretation of the MapQuest locations. Some of my locations may seem like a stretch, but I am hoping that they can be corrected.”<sup>74</sup>

When online investigation failed to produce a unified theory, the thread organized a series of massively cooperative scouting missions, posting results to collaboratively authored documents. Dorkmaster wrote: “This is an urgent appeal from a beekeeper for some organization and some determination from my fellow players. We appear to be stuck in the mud on this GPS/axons puzzle. Here is what we need to do: VISIT all of these locations—OR at the very least, find out via the internet or whatever (in no small detail) what is at each one. Post your findings [on the wiki] ... We've been brainstorming for days on the data we have and have come up with

nothing. I think this is because we have to go out and gather MORE data. The coordinates tell us where to find it.”<sup>75</sup> The specificity of each coordinate meant that a player located near an unchecked data set could play a hugely important role in the analysis, even if he or she had not originally contributed the strategy of investigating locations. As mike3854 wrote: “Finally I might be able to stop being a lurker and help. As soon as I can, I'll take my camera with me and check the Kissimmee FL locations, seeing as how they are close to my house. If there is anything important there, I'll make sure you see what I see.”<sup>76</sup>

In the end, however, the literal group won out with its most persuasive analysis that players should prepare to be at the locations on August 24, 2004, when the countdown hit zero. The success of their argument was only possible as a result of evidence collected by the relative thread, and in the wake of the numerical approaches ruled out, was directly sparked by some of the location scouts' observations. Giskard writes: “Something that just hit me... there's a lot of mention of coordinates being in malls, stores, airports, etc. Could it be they are locations of public phones? That would be awesome... if all of them got a call on august 24.”<sup>77</sup>

Beekeepers used their earlier work during the cognitive phase to corroborate this interpretation. Cedmond writes: “what if these are all locations of public phones (as previously suggested)? there is a great amount of text in the poems and code about the entity trying to speak, find it's voice....” Xhylph wrote: “‘Axons go hot’ could be the same thing as ‘pathways of information are accessed’, which would support the phone theory.”<sup>78</sup>

Literal players combined narrative analysis with further location scouting. Peccable wrote: “I grabbed some maps off the 'net of the Philly position and I'm almost entirely certain that there's a set of payphone on that \*precise\* (northwest) corner. Melissa's new rant includes the fact that she wants to create a voice for herself. My theory: At 5:07pm EST (I believe that's when the

AXON countdown ends) on August the 24th, the phones at the various coordinates will ring, and Melissa will speak. Like I said, I'll check tonight if there \*is\* an actual set of phones there, but I literally live around the corner from there and I'm pretty familiar with the area. Anyone have supporting data? Or non-supporting data.”<sup>79</sup> Members of the group used the tools compiled by the numerical and relative players to reinforce their own work. Atomant411 wrote: “Using both the road map and the satellite image map from the excel spreadsheets on the WIKI, I decided to drive by the Garland point today after work. If the maps are accurate on the spreadsheet, the point is actually in front a United Artists movie theater (enticingly close to a row of payphones) in the shopping center on the Southeast corner of Garland and Beltline...I've been a lurker throughout this entire puzzle, and haven't had much to say on the matter, thus the reluctance to post, but I thought this was important.”<sup>80</sup>

In all of these ways, the players actively wove the three self-differentiated threads of investigation back together, drawing on their initial story work to arrive once again on common ground. And so as the August 24 date loomed nearer, player vpistev vocalized what the majority of Beekeepers had collectively agreed upon: “the fact that the coordinate are specific to the .000xth degree tells me that they do in fact mean a physical location in the real world. If this were merely a numeric or graphic puzzle, the PMs wouldn't have been that pinpoint, they could've just as easily made a puzzle to the .0xth degree....Somehow, something will be *transmitted* (as tagged in the source code) to these actual, physical locations, something that will make Melissa ‘wide awake and physical.”<sup>81</sup>

Ultimately, the players converged on this single interpretation, backed up by many thousands of visits to GPS coordinates, and hundreds of thousands of viewings of the field players' digital photo reports and verbal summaries of what was observed on location. But did the players who



had not originally backed this “literal” reading of the coordinates feel left out or unsuccessful? By all accounts, no. Ultimately, participation in the search for the solution was what mattered most. As a player named Sherpa observed: “There're a lot of trees to bark up the wrong way before hitting on anything.”<sup>82</sup> And indeed, for a game as open-ended and initially chaotic as *I Love Bees*, all of those trees must be barked up to arrive at a single interpretation through process of elimination. For search and analysis players, failing to solve a puzzle in this kind of massively collaborative network does not mean failing to make any kind of contribution at all. Instead, it means successfully eliminating a framework so that others’ resources can be redirected to still viable analytical tactics. As both Levy and Vinge argued, collective intelligence as a problem-solving pedagogy is extraordinarily inclusive. It engages a set of players that is as broad and diverse as possible, in order to work through problems of unprecedented scale and complexity.

What is it about scale and complexity that supports inclusive participation? How, in the case of the *I Love Bees* GPS coordinates, can a single data set support such a vast range of interpretations and yet also directly inspire such a rigorous course of collective analysis? I would argue that the primary puzzle of *I Love Bees* embodied a *meaningful ambiguity*. That is, the data set lacked the clarity of formal interactive instructions, yet maintained a distinctively *sensical* nature. That is, the choice and ordering of the coordinates did not seem *nonsensical*. Instead, its arrangement was structured and seemingly intentional enough that it promised to mean something, if only approached in the right way. This meaning was implied through the specificity, volume and overtly designed presentation of the data.

Moreover, this abundance of pliable data provided inexhaustible ways for players to take differentiated action, whether it was to perform calculations, make maps, conduct web searches, or visit real-world locations. In the GPS data set, there was enough perpetual ambiguity that

there was always something more for a member of the Hive Mind to do. There were no limits on plausible actions to take. At the same time, there was enough structure and specificity of data to make the application of data processes a challenging, time-consuming affair. So there was never a shortage of supporting work to be done.

How important was ambiguity to the formation of a collective intelligence? It was absolutely crucial for two reasons. First, ambiguity creates a *critical* and *constructive* relationship with digital media and systems. It serves a psychological function, to draw players into the collective. Computer-human interface researchers William W. Gaver, Jacob Beaver, and Steve Benford argue in their scientific article “Ambiguity as a resource for design” that “ambiguity... is a resource for design that can be used to encourage close personal engagement with systems.”<sup>83</sup> They write: “Ambiguity can be frustrating, sure. But I can also be intriguing, mysterious, and delightful. By impelling people to interpret situations for themselves, it encourages them to start grappling conceptually with systems and their contexts, and thus to establish deeper and more personal relations with the meanings offered by those systems.”<sup>84</sup> The GPS data set was intentionally designed to thwart easy interpretation. And as Gaver, et al observe, “By thwarting easy interpretation, ambiguous situations require people to participate in meaning making” (235).

For the players of *I Love Bees*, this grappling with ambiguity was meaningful not only on a personal level, but also on a collective level. On a discussion thread that was still active months after the game concluded, one player defined the emergent CI specifically as a search for meaning in the chaotic system of the game. “We experienced being part of a collective intelligence... participating in a search for, or perhaps creation of greater, shared meaning.”<sup>85</sup>

By asking players to cooperate to make meaning out of an ambiguous system, the game-based hive mind celebrates individual perspective even as it embraces the larger, intricate, intelligence

that emerges only at the scale digital networks afford. This ability to value both simultaneously is a fundamental lesson that search and analysis games work to impart, in addition to the practical technology skills of how to use collaborative software and communicate data and theories to the network. As Levy writes, “I am not interchangeable. I have an image, a position, dignity, a personal and positive value within the knowledge space. All of us have the right to be acknowledged as a knowledge identity.”<sup>86</sup>

To underscore the importance of this message, I want to return here to the Vinge’s imagined CI curriculum of the year 2025. *Rainbows End* is not only optimistic about the future power of massively collaborative networks, but also realistic and insightful about the challenges they pose to individual sense of self-worth. In one scene, a Search and Analysis student admits how insecure she is about her ability to contribute to the collective. “There was a kind of frightened look in her eyes [as she asked]: ‘But some people are better than others.... Or maybe others are just sharper.... What happens if we try our hardest, and it just isn’t good enough?’”<sup>87</sup> The inclusion of meaningful ambiguity in *I Love Bees* expressly addresses this concern. The plausibility of so many diverse interpretations empowered players of all kinds of skill levels, natural abilities, inclinations and interests to achieve success. This kind of massively inclusive engagement is increasingly vital as we think about the future of learning. It ensures that no player is left out of the game, no individual discouraged or excluded from the opportunity to contribute to participatory culture.

It is true that ultimately, there was only one best solution to the GPS puzzle—scout the GPS coordinates in advance of August 24, 2004; find all of the nearby payphones; arrange to station players near all of those phones at the appropriate time code; and make sure the players show up at the right time and place. But in the bigger picture of the game, the many “failed” analytical

frameworks suggested by players in the weeks before the countdown hit zero played an important role. In the twelve weeks that followed the first ring of a payphone, over one hundred new puzzles appeared on [www.ilovebees.com](http://www.ilovebees.com). These post-countdown puzzles required players to use morse code, mapping, sophisticated math, research into scientific literature, physical modeling, advanced classification schemes, anagrams and other wordplay, and more—in short, as many of the popular emergent frameworks that had not succeeded in solving the GPS puzzle that could be squeezed into the game. The game was designed to reward the creative, exploratory work and lateral thinking of the hive mind by creating ongoing opportunities for their experimental strategies to be applied successfully.

Next, as Gaver et al argue, ambiguity “allows designers to engage users with issues without constraining how they respond... It gives designers the ability to suggest issues and perspectives for consideration without imposing solutions.” This is the second critical function that meaningful ambiguity plays in enabling a collective intelligence to emerge. The final results of a CI effort cannot be prescribed in advance by a design team consisting of a half dozen people. CI must emerge from the massive collaboration of hundreds, thousands, or more. Therefore, the full solution *cannot* be pre-designed. The puzzle of a search and analysis game must be ambiguous, and therefore open-ended enough to allow the players’ emerging CI to suggest more complex solutions. The designers, through ambiguity, must cede control over the final scope and dimensions of the game’s solution to the players. Gaver, et al write: “The artifact or situation sets the scene for meaning-making, but doesn’t prescribe the result. Instead, the work of making an ambiguous situation comprehensible belongs to the person, and this can be both inherently pleasurable and lead to a deep conceptual appropriation of the artifact” (236). Indeed, the

players' appropriation of the intentionally ambiguous game content led to the third and final phase of CI gameplay, the coordination stage.

### **Stage Three: Evolving a Collective Intelligence**

Meaningful ambiguity promoted wildly diverse interpretation. In the case of *I Love Bees*, the players' interpretations far exceeded what the designers could have anticipated and created responses for in advance of live gameplay. In order for meaningful ambiguity to effectively support collective intelligence, therefore, the system had to be flexible enough to incorporate the myriad unexpected uses and ingenious attempted interactions resulting from its open-ended challenge. It had to support *real-time redesign* that enables the hive mind to evolve over time.

In the production of traditional computer games and videogames, a formal line exists between the construction of the game and the play of that game by an audience. The vast majority of digital games are fully developed and finalized before they ever reach the players. They are shipped to stores or made available online for download as a completed product, not a work-in-progress. The programmers of *Halo*, for instance, do not create secret new levels after the videogame has been shipped to consumers. They do not tweak the fighting algorithms of various enemies in order to make the game more difficult for players who have mastered it. Nor do they add new weapons to the players' inventory based on the expressed desires of fans on public *Halo* forums. It is true that eventually, the same design team may produce a sequel that provides more play and different play—hence, *Halo 2*. However, the sequel is a different product altogether. The original game itself is not fundamentally flexible to players' emergent strategies, desires, and skills. Ultimately, the work of the game designers and developers ends the day the game reaches the players' hands.

The opposite is true for a game like *I Love Bees*, which is produced to a significant degree in *real-time*—that is, in live procedural response to players’ interactions with it. When *I Love Bees* launched in July 2004, approximately sixty percent of the final content had been created. The other forty percent was partly planned, but a great amount of design space was left entirely open.

42 Entertainment’s team of behind-the-scenes writers, programmers, story directors and gameplay stage managers was assembled to create post-launch content that would build on what the players created. As cultural critic Stephen Johnson observes, when it comes to producing the stunning interactive effects of traditional computer and videogames, “it’s all just a bunch of algorithms behind the curtain.”<sup>88</sup> In other words, most digital games are closed systems of pre-programmed rules and pre-populated databases. When it comes to a real-time search and analysis game like *I Love Bees*, however, it’s *not* just algorithms behind the curtain—it’s a team of live game designers, re-populating the data bases and rewriting the rules as the game is being played. As lead community designer for *I Love Bees*, I had the job of monitoring the interpretive and problem-solving efforts of the player community so that we could adapt the game to their evolving collective profile. Each day, after scouring player forums, blogs and emails, and lurking in their chat rooms, I reported their most interesting new theories and strategies to the other lead designers. In turn, the other designers crafted ongoing game challenges, as well as the climax of the interactive story, in response to the skill sets and the investigative framework the players themselves had developed. Through this real-time, flexible design, we worked to encourage the existing *Halo* fan base to hone and strengthen their CI powers. This evolutionary phase is the third and final stage of CI game play, which I call the *coordination* stage. It consists of an *iterative*, or cyclical and repetitive, attempt to solve similar problems with increasingly sophisticated strategies and increasingly powerful techniques. Lead writer Sean Stewart

describes this iterative process as a “call-and-response, jazz-style interaction.... It increases the ownership of the players in the game enormously.”<sup>89</sup>

The creation of over one hundred post-countdown puzzles to incorporate “failed” analytical frameworks of the hive mind was an important part of this call-and-response game design. Consider a non-GPS-related example of a challenge that was created post-launch. In designing the central hacked website for the game, technical director Jim Stewartson had invented a fictional, object-oriented programming language through which various artificially intelligent programs communicated with each other. Among the programs that used this language were programs named the System Distributed Reflex Peril (the SPDR) and the Pious Flea. Throughout the first twelve weeks of the game, Stewartson dropped bits and pieces of this futuristic code into web pages and emails sent by the programs, including the 150 lines of code that players initially collected and interpreted.

Stewartson never provided players with any direct translation or explanation of the fictive programming language. However, players discovered early on that it was possible to discern the meaning of specific lines of code by observing their impact on other characters and on the composition and functioning of the website. In doing so, they would be able to translate progress into narrative. The players therefore took it upon themselves to collect and to translate every line of code, in the hopes of gaining a functional fluency in the language. From their compiled examples they created a wiki-based guide to the language, which they themselves named *Flea++* in playful reference to the actual present-day computer programming language *C++*. An example of *Flea++* code as translated by players appears below.

**Code:**

```
grope: seeker > !attach Princess
```

Remember that > is a question in most instances.  
This means "Can I attach to you, Princess?"

**Code:**

```
fail "msg: SPDR-5.14.3
```

"No? SPDR-5.14.3?"

**Code:**

```
evade evade evade
```

"Crap. RUN!!!!"

**Code:**

```
!probe extern proc 1
```

"What just tried to attach to me?"

**Code:**

```
rogue proc
```

"You're not anything I recognize, you're foreign, not friendly at all"

**Code:**

```
!bite rogue proc 1  
Recurse
```

"I'm putting a stop to this."  
"And I'm not going to stop attacking you until I'm sure you're dead."

**Code:**

```
!splotch  
clean confidence 100
```

Flea: "OH I AM DEAD"  
SPDR: " Yes, you are."

This dialogue, composed by the players out of fragments of found code, was actually quite a climactic one in the overall story. As the player providing this translation correctly surmised, the



final pieces of code document the death of the Pious Flea, the very character for whom the players named the language.

In a post-game chat between players and the puppet masters of *I Love Bees*, Stewartson revealed that as the game progressed, he worked directly from the players' *Flea++* guide to write new game content. He admitted: "to be perfectly honest, after a while, i started to use the syntax cheat sheet from the [players-created] wiki."<sup>90</sup> Indeed, the players took such ownership of the language that they played with it extensively outside the formal challenges of the game. The players excitedly told Stewartson in the post-game chat, for instance, about "Flea++ apparently becoming a geek-trendy lingo, similar to [gamer] 1337speak", or "elite speak" ([17:17]). One player explained that players exiting chat rooms at the end of the night would say "!grope pillow" instead of "I'm going to sleep."<sup>91</sup> Another informed Stewartson: "I translated Edgar Allen Poe's 'Tell Tale Heart' into Flea++."<sup>92</sup>

Together, the formal documentation, successful translation, and creative use of *Flea++* signaled that mastery of the fictional programming language was a key component of the player's collective intelligence. Stewartson therefore decided to create a crucial *Flea++* game mission in the final weeks of the game. During this mission, he manned an email account that players discovered had been hijacked by an AI program fluent in *Flea++*. In real-time, hundreds of players sent bits of code to the character; Stewartson made live updates to [www.ilovebees.com](http://www.ilovebees.com) to reflect the impact of their code, as if the commands had been directly implemented by the character. As the players quickly learned not to cancel each others' commands through conflicting emails, and to combine lines of code to achieve their desired result, they demonstrated an emergent command of the language that they themselves had helped to formally compose. Indeed, as Stewartson told me in a personal interview, "Before the players

put together all of the code on the wiki, I wasn't sure the language really made sense. They were the ones who made sense out of it. If they hadn't come up with their own standard version, I never could have pushed them so hard on the final Flea++ challenge. They made that puzzle, really, because the solution came straight from the wiki they wrote."<sup>93</sup>

The *Flea++* mission shows how real-time game designers can create new content on the fly to encourage and reward the players' emergent CI, simply by paying close attention to the skills that develop in the audience and looking for opportunities to capitalize on them. But even more importantly, there must be formal mechanics for real-time design built into the interactive arc of the game. As Vinge's fictional Search and Analysis teacher reminded her students, "synthetic serendipity doesn't just happen. By golly, you must create it." In *I Love Bees*, a twelve-week cycle of calling payphones every Tuesday was implemented in order to create this kind of organized serendipity, in which the game design emerged as perfectly coordinated with the players' levels of ability and expertise. None of the payphone challenges were designed before the game launched. Instead, the entire team collaborated on their design each Monday night after receiving my latest report on the players' most recent efforts and discussion.

By the time the countdown hit zero on August 24, the players were ready for far more than we expected. They showed up at the GPS coordinates laden with every form of digital communications technology and personal media devices you could imagine. They were prepared for virtually anything. They had compiled databases of each others' cell phone numbers in case they needed to relay information to or from the field. They had stationed significant numbers of players online in case real-time research was necessary to complete the mission. They brought large numbers of friends and family with them in case a group performance was necessary.

But what they were in fact asked to do once they arrived on site, as it turned out, did not require any of those improvised supplies, allies, or information systems.

Instead, at each coordinate, at the appropriate time, a payphone rang. If players located and answered the ringing payphone, they were asked a pre-recorded question by Melissa, the Operator. (The first question: “Who is the enemy of mankind?” The answer: “The Covenant”, the enemy alien race in the *Halo* games.) If they answered correctly, they heard thirty seconds of a *War of the Worlds*-style radio drama. Their mission? To intercept as many pieces of the drama as possible and to report back to other players what they had heard. Players heard 30 different bits of drama that day; all were successfully intercepted in at least one location, and players met back up online to put the narrative pieces together. They fulfilled their mission perfectly.

But by creating such a robust communications infrastructure and coordinating extensive mobile computing supplies, they had performed at a greater capability than we had expected. We felt as if they were asking us to ask more of them. They were directing us to direct them to do something specific: put their extreme coordination skills to the test.

Because August 24 was the first of twelve weeks’ worth of GPS missions, we could do just that. In the weeks that followed, the coordinates page updated on a biweekly basis, and the number of coordinates posted per week jumped from the starting count of 210 until a total of over 1000 were posted during the final week of gameplay. Ultimately over 40,000 phone calls were made to over 1000 payphones around the world. To handle this increased distribution, players posted over twelve thousand messages and weekly phone maps to a board called “Axon Coordination.”

We started adding randomly distributed live phone calls with more complicated, live activities—precisely because the players showed us they were capable of succeeding at more

challenging kinds of interaction. We also started calling the phones in combinations that made it increasingly difficult for local groups to coordinate effectively. For example, we regularly rang a dozen payphones in Washington, D.C.'s Union Station, which were spread out throughout the massive train station. At the start of the game, phones were scheduled to ring one at a time, with enough minutes spaced out between them so that the D.C. team of players could move from one to the next, methodically answering all of the calls and collecting all of the content. By the end of the game, all dozen phones were ringing at precisely the same second, forcing players to divide and conquer, while communicating in real-time with each other via mobile phones to compare answers to the questions and report any live challenges that were given.

As the players pushed themselves to succeed at every challenge, we were forced to present them with a problem that we ourselves weren't sure they could successfully solve. We called it the "relay mission", and it was designed to make or break their collective intelligence. Shortly after sunrise on a Tuesday late in the game, we directed the voice actress playing Melissa the Operator to start making live calls to phones on the East Coast. She asked whoever answered the phone tell her something personal—for instance, a five-word phrase that described something they are very, very good at. The Operator then informed the player that she would be calling another payphone somewhere in the world, as soon as one hour from that moment. Whoever answered the phone needed to repeat back to her the same five-world phrase. Then she hung up, providing no information about which phone she intended to call.

Our plan was, over the course of the day, to repeat this relay mission up to a dozen times, shortening the time increments until we would posed our final, seemingly impossible challenge: to relay an improvised personal message worldwide with only a fifteen-second time differential between the first call and the second. But we were fairly certain the players would never get that

far. We had designed a number of failure responses so that we could reward players for however close they came, fully expecting them to eventually hit a wall past which they could not coordinate and perform.

The players, however, never hit that wall. By using their early axon coordination spreadsheets—they knew which players lived near which phones, and had their mobile contact information—and by consulting the timeline of GPS coordinates for that day, and cross-referencing that data against their knowledge of which payphones the Operator had favored in the past for live calls, they were able to deduce which phones were likely to ring, and who was most likely to answer those phones in the time window the Operator presented. They then set up a relay team of online players broadcasting each secret five-word phrase as it was invented to all players known to be in the field; hundreds of players online called hundreds of players at payphones so that they could update each other virtually instantly.

In the end, the iterative design of our payphone events gave us powerful flexibility to help the players' collective intelligence evolve. From the outset, the game was designed to allow for a dozen re-designs. And as the game changed, the players' strategies evolved, creating a positive feedback loop of CI. As the players became more collectively intelligent, the challenges became more complex. And as the players invented smarter strategies and honed their coordination skills to meet these challenges, the designers were pushed to imagine future challenges even more difficult and confounding. Before we saw what the players were capable of, we never imagined that a massively multi-player team of young *Halo* fans would be capable of building, in one day, a worldwide, instantaneous, mobile broadcasting platform. The idea to ask them to do just that was only possible after the players' brilliant coordination efforts emerged.

This real-time flexibility, I believe, is the true power of a puppet-mastered search and analysis game. Ultimately, the game can be designed beyond the scope of anyone's initial expectations—not only the players' expectations of what they can accomplish, but also the designers' *and* the public's perception of what the hive mind can achieve. The players themselves create the unprecedented context for achieving previously unimaginable goals. As these emergent goals are met by the players, the stakes of the game grow: no longer is it merely teaching the players CI. The game is also empowering players to teach the world what such a CI is capable of.

## **Conclusions**

As the leading edge of research, industry, politics, social innovation and cultural production increasingly seek to harness the wisdom of the crowd and the power of the collective, it is urgent that we create engaging, firsthand experiences of collective intelligence for as wide and as general a young audience as possible. Search and analysis games are poised to become our best tool for helping as many and diverse a population as possible develop an interest and gain direct experience participating in our ever-more collective network culture.

In *Convergence Culture*, Henry Jenkins considers the role that popular culture should play in cultivating collective intelligence. He argues: "Right now, we are learning how to apply these new participatory skills through our relation to commercial entertainment... for two reasons: on the one hand, because the stakes are so low; and on the other, playing with popular culture is a lot more fun than playing with more serious matters."<sup>94</sup> Jenkins predicts that as a society, we eventually we evolve our collective intelligence interests in the direction of real-world, rather than fictional, concerns. However, I am suggesting with this case study that for young students learning about CI for the first time, popular culture and online entertainment will remain the most effective spaces for learning how real-world massively collaborative participation works.

In *Get There Early*, technologist Bob Johansen argues that immersive gaming can prepare players for future changes in network culture. He writes: “Immersion helps get a feeling for what’s possible. Immersion helps you try out different ways of acting, so you can develop your own agility.” Indeed, as I have documented with this *I Love Bees* case study, the immersive aspects of search and analysis gaming provide a visceral, first-person, hands-on experience of collaborative cognition, networked cooperation and real-time coordination. Players develop a familiarity with collective intelligence techniques through direct experience. They gain confidence and fluency in emerging technologies and CI strategies by playing with new network platforms and multi-user applications in increasingly complex scenarios. Search and analysis games, with their iterative real-time redesign, are perfectly structured to provide such scaffolding challenges—a key aspect to mastering new modes of problem-solving and cultural participation.

As massively-social experiences, search and analysis games are also especially well-suited to encouraging meta-level reflection on the skills and processes that players use to meet new challenges. Being a part of a massively multi-player game community means sharing your thoughts and experiences with your fellow players. Finally, and perhaps most importantly, as learning systems, collective gaming encourages risk-taking learning in a low-risk setting. As Johansen observes: “Learners get to dive in and learn in a first person way, without playing for keeps until they are ready.”

I want to conclude this case study with a letter from an *I Love Bees* player, for I believe the gamers’ personal experience speaks best for itself. Several months after *I Love Bees* ended, I received an email from “Rose”, a mother who played the game with her 14-year-old son, a high school student and an avid videogamer. In the letter, she described the game as a powerful

tutorial in networked collaboration for them both, one that made them feel excited about participating in collective intelligences in the future. She writes:

It is really important to me that you, and other people, understand the differences that alternate reality gaming has made in our way of thinking. It has powerfully affected our attitudes about what is possible. The game for me has been about gathering a first hand knowledge of how a large community can function, including the role of technology. I know that large scale communities can work and be extraordinarily effective. I am not afraid of the complexities.<sup>95</sup>

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