Lead User Discovery through Netnography: Transhumanist Subcultures of Grinders and Biohackers

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Abstract

Industry has already been set as a precedent that lead users are indicators for future products and areas of forming trends. By following where these lead users come from, understanding their motivations and intent of use can help discover new products. In this paper there are two groups under the ideological umbrella of Transhumanism, "Grinders" and "Biohackers" which are fringe groups where we felt there were possible lead users. To study them, we employed the use of the Unified Theory of Adoption and Use of Technology as a framework to gain an understanding of their characteristics and motivations. By doing so, we understood them well enough to apply netnography in conjunction with lead user characteristics to identify lead users on internet forums. From our research methodology, we found lead users within these two groups and possible marketable products. Some of which include implantable technology and methods to better understand people's nutritional needs through genome testing.

Introduction

The purpose of this document is to describe the characteristics and motivations of two transhumanists sub-groups (Grinders and Biohackers) using the methodology of netnography within a framework of the technology adoption and then describing them as lead users. These groups are part of our interest because they are seen as extreme fraction of the transhumanist movement by the utilization of technology and the enhancement of the human body. It is the purpose of this paper based on a netnography research of two online forums to describe where this two groups come from and to help differentiate their characteristics and motivations by using the UTAUT framework and finally to understand why they are doing what they do and if they fit in the lead users' criteria.

Transhumanism movement

The term was first introduced by Max More in 1990 in his essay "Transhumanism Toward a Futurist Philosophy". They defined the philosophy of the transhumanist as the study of the potential of the science and available technology to improve the human condition and its limitations. Transhumanist seek to improve the humanity physically, intellectually and physiologically by using their intellectual knowledge and the given tools by technology[1].

Transhumanist want to have control over the all the aspects affecting the life of people by achieving immortality. They also want to reduce the chances of having a disability or a physical illness, limit the duration of an injury and reduce the suffer by having control of the emotions. They value the knowledge and use the science to try to improve the quality of life.

They are using their bioethical knowledge to help in areas like cloning, euthanasia, abortion, DNA researches, etc.

This community has been working on several projects for decades. One of the projects they have done was in 2006 when a Belgian transhumanist published a documentary of a method that is trying to use the human brain and through electrical signals get the code for each action and feeling of the humans. After getting the code, they created a chip to get it implanted in a person's' brain. The purpose of the chip was to send electrical signals to the individual and create feelings of sadness, anger and euphoria. Different Transhumanist have tried this method with mice and even Google in 2014 hire Ray Kurzweil one of the leading transhumanist in the field to explore the possibilities of humans getting access to the same information as a Google search engine.

They use the real-life examples to think that the human life can be handle the same way. For example, they think that a car can function forever as long as it receives consistent maintenance service. They say the same happens with a human body, it needs to be under constant repairs and for this they want to use the best combination possible of science and technology[2].

Problem statement

Using the methodology of netnography within a framework of UTAUT, can we identify the characteristics and motivations of transhumanist subgroups (grinders and biohackers)? Utilizing these characteristics, can they be described as lead users for future products?

Who are grinders and biohackers? Why are they doing this? Do they fit lead user criteria?

Research Problem Roadmap

In this section we want to present an overview of the flow of our research paper to give a clear understanding to the reader on the step to step process we followed to get to our conclusion.

After we clearly defined our problem and identify the questions we wanted to solve, we began by describing where these two groups come from and how the transhumanism movement is related to their beliefs. Then using as a framework the Unified Theory of Adoption and Use of Technology, we described the characteristics and motivations of these two transhumanism sub-groups. By using these characteristics and having a clear idea of what their motivation is, we became members of two forums (One per group) to research further on what they are currently doing and what are the topics they are discussing in these forums. Finally, using netnography as a methodology of lead user identification we used all

the information found and applied this method to the information found in the forum of the Grinders and Biohackers.

Characteristics and motivations

Grinders and Biohackers evaluated using the four main determinants of UTAUT

UTAUT

The Unified Theory of Adoption and Use of Technology was put forth by Venkatesh et al as a means to take an assortment of eight theories which derived over the years in order to create a unified theory. The main stay of the theory has four main determinants and four moderators. The four main factors by which it was formulated are Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions [3].

Utilizing the theory behind UTAUT, the subcultures of "Grinders" and "Biohackers" by attempting to characterize their behavioral intention and use behavior. The intention is to use the four determinants to help differentiate those two groups and determine the purpose of their intent and use.

Grinders

Lepht Anonym is a famous and outspoken Grinder and she wants everyone to know "the door to transcending normal human capabilities is no farther away than your own kitchen. It's just going to hurt like a sonofabitch"[4]. This statement pretty well sums up what the grinder movement is about. Grinders are biohackers that take the idea of transhumanism to the extreme through physical modification. Grinders practise technology implantation on a DIY level commonly in their own homes with rudimentary tools and no anesthetic. Doctors will not touch them, resorting to implantation in their homes using tools found around the house. Some tools for this practise could be scalpels if they are lucky, scissors, knives, needles, and even potato peelers. Implantation or sometimes referred to as "installing" or "upgrading" is usually performed in small laboratories, garages, basements, closets, and improvised workspaces [5]. Others have made friends with or convinced tattoo and piercing specialists to assist in a safer sterile environment.

A common implant for grinders is permanent neodymium magnets encapsulated in a biosafe coating. These implants allow grinders to pick up ferromagnetic objects and can provide a tactile response to environmental electromagnetic fields. The most common

implantation site for magnets is directly adjacent to the finger pads on the non dominant hand. This provides a highly sensitive response to electromagnetic fields but also is susceptible to impact resulting in sharp pain [5]. RFID implants are also common with the grinder community. These implants can be used as electronic storage devices and two way wireless communications. The FDA has approved implantable RFID chips and there are several commercially available on the market. Due to the rebellious nature of the grinder culture, it is common for individuals to build their own electronic implantables for different purposes as well as take standard commercial magnets and attempt their own biosafe coatings [6]. The startup company Grindhouse Wetware in Pittsburgh has developed several open source products for the purpose of implantation to upgrade a person's ability to sense their surrounding environment. Their arm implant product Circadia can be used to track biomedical data and upload the data using bluetooth. Another product offered by Grindhouse is the Bottlenose that interacts with magnet implants via induction. This product allows a person to have a direct sense response to sonar, UV, WiFi or thermal information.

The four main groups of UTAUT (performance expectancy; effort expectancy; social influence; facilitating conditions) can be applied to the grinder segmentation as follows. The main focus for this application will be in relation to the physical implantation of magnets and electronic devices. Each of these implant types may have differing levels or interrelationships between the four main groups.

Performance Expectancy

The grinders expect a high level of performance. Whether this is the ability to interact with electronic devices or the creation of a new sense to feel electromagnetic fields. There is a distinct physical and tangible result to their implantation. They expect to have an enhancement or upgrade from their basic senses. Many interviews with grinders having magnetic implants suggest the ability to sense the unique outputs that different devices produce. Some people are unable to articulate these sensations well while others having a better understanding of electromagnetic fields can describe the different sensations in great detail [5].

Effort Expectancy

Due to the underground nature of the grinder culture, most implants are performed in private homes or at a group site not a professional surgical center. This is high risk and effort for the person due to risk of infection or complications and the absence of anesthetics resulting in high pain. Both the difficulty of implantation and no guarantee of a successful outcome results in a high level of effort expectancy.

Social Influence

Many grinders identify with the biopunk movement which generally examines the dark side of genetic engineering and represents the low side of biotechnology. The experiments performed by grinders do not produce a social status improvement. Their primary objective is self enhancement through technology and biology integration for the purpose of pushing the human race forward outside of social norms. Many of the communities are found in underground groups and anonymous online forums. Any engineering or science professionals must take care in maintaining anonymity due to the legality and/or liability from giving their advice or expertise.

Facilitating Conditions

The facilitating conditions for grinders can be split depending on the individual. While many grinders may utilize commercially available magnets and RFID chips with biosafe coatings there is still a sub-segment that use implants of their own design and creation. The use of homemade magnets with biocoatings do not have any benefit beyond that of the commercial grade other than a price difference. The RFID and electronics on the other hand can be created to have far greater performances than the limited devices that have been FDA approved. This can create an inverse relationship between the performance and effort branches of UTAUT for higher performing but lower facilitating condition electronic devices.

Biohackers

The first definition of "biohacker" came from Michael Schrange in an article called "Playing God in Your Basement" in The Washington Post [7]. In this article, Schrange describes the "Rise of the Biohacker" as a similar phenomenon to that of the computer hacker, through in part to the accessibility, ease of use and cheapness of modern biohacking. Biohacking is known through various terms such as "homebrew biologists," "DIY Biology," and "biotinkers" and can be distinguished by their extensive effort to self-measure and monitor behavioral, physical, biological and genetic metrics for self-knowledge and improvement and fall under the Quantified Self movement [8]. Therefore the biohackers can be differentiated as a rather independent group from the Grinders since they tend to make their self improvements through quantifiable, well-researched and documented studies. The result of their research usually results in no direct physical modification and they stay within the bounds of human capabilities, much to the contrast of the grinders.

Biohackers use an array of tools to try and optimize human biology: microbiology, supplements, meditation, and nootropics. Biohacking allows the user to try and optimize human biology to the bounds of their capabilities rather than push them. Given the contrast of the biohackers to that of the grinders, applying the Unified Theory of Use and Adoption and Use of Technology makes sense. By applying the four determinants of this theory, the end use and intent of the group can be better understood.

Performance Expectancy

Performance Expectancy is a rather important determinant for the group but they tend to have realistic expectations when it comes to the performance of end use. Typically bounded by the capabilities of what is actually possible by human biology not what could lie at the extremes. While though they expect increased performance through meditating or other means, they are do not extend beyond what is capable of of what the body is doing, at most by being able to increase their performance, there expectation is to reset the boundaries of their capabilities, not break beyond. Much like computer hacking, the biohacker is an enthusiast. Therefore the performance enhancement is largely done for the intellectual curiosity, not necessarily for the performance therein. So knowledge for the sake of knowledge is the primary facilitator for their performance expectancy [9].

Effort Expectancy

Ease of use is not as important to the biohackers because the perceived ease of use is not a primary concern. Often there is a high learning curve to be within the realm of biohacking due to the need to understand the interactions and methodologies of the use of supplements and meditation. Ease of use is helped through a rather robust group of enthusiasts to help others come up to speed but the high learning curve help the group as a whole by weeding out those whom are not true enthusiasts for knowledge.

Social Influence

Social influencers seem to play the most important role for the biohackers, they are derived from community based knowledge. Through informal community networks they can practice their pastime without molestation, which is important for them due to the need for "small-scale settings within a community or movement that are removed from the direct control of dominant groups [10]." Biohackers tend to be removed from established post-academic institutions, they feel that they must be insulated from the dominant groups to keep intellectual solidarity and keep a space where ideas and tactics can be challenges without intrusion[11][12].

Social influence in regards to the subjective norm is a primary tacit for the biohacker as it allows the freedom to explore unconventional or non-socially acceptable practices. Therefore they must be insulated to protect their image and gain approval for research within their community networks. So the use and intent of the biohacker is to foster openness, freedom and collaboration amongst their colleagues [8].

Facilitating Conditions

As previously discussed, the ability of the biohacker to be insulated in informal community networks implies that the framework for the facilitating conditions is self imposed on the group, the biohackers as a group creates their own facilitating conditions by which they can research and condone experiments on supplements, meditation, nootropics and manipulate microbiotic conditions. So the facilitating conditions seem to be rather self perpetuating and they create their own means of organizational and technical infrastructure.

Compare and contrast

Grinders	Biohackers
Grinders are biohackers that take the idea of transhumanism to the extreme through physical modification.	Allows the user to try and optimize human biology to the bounds of their capabilities rather than push them.
Practise technology implantation on a DIY level commonly in their own homes with rudimentary tools and no anesthetic.	Tend to make their self improvements through quantifiable, well-researched and documented studies.
High performance expectation by the ability to interact with electronic devices or the creation of a new sense to feel electromagnetic fields.	They have realistic expectations of what is actually possible by human biology not what could lie at the extremes. They stay within bounds of body's own capabilities.
Due to the underground nature of the grinder culture, there is a high risk of infection and/or complications and there is no guarantee of success or new/improved senses	It is more important to understand the interactions and methodologies of the use of supplements and meditation than the ease of use.
The experiments do not produce a social status improvement.	Social influencers seem to play the most important role for the biohackers, they are derived from community based knowledge.
They use practices are outside the standard medical practices. There is a sub-segment that use implants of their own design and creation of magnets and RFID chips.	They create their own facilitating conditions by which they can research and condone experiments on supplements, meditation, nootropics and manipulate microbiotic conditions.

Table 1: Comparing characteristics of Grinders and Biohackers

Research methodology

Netnography as a Method of Lead User Identification

Typical users of existing products are poorly situated regarding the difficult problem-solving tasks of developing new products and services, lead users are well positioned to do so. Lead users are generally defined by displaying two characteristics: they face needs that will be general in a marketplace but face them months or even years before the majority; and they expect to gain high benefits from obtaining a solution to the needs they face [13]. By employing a netnographic approach to the Grinders and Biohackers previously described through the four determinants of UTAUT, we can use a systematic approach to analyze these online groups.

Netnography adapts ethnographic research techniques such as observation to study cultures and communities that are emerging through computer mediated communication; therefore, it is a combination of ethnography and internet resources.. Through this we will take a non-participatory approach, by observing these communities in open forums. Data collection from these online forums can be directly observed as well as information gleaned from the community members and their interactions [14]. The reason for using this netnographic approach is because empirical studies show that lead users participate in online communities to contribute knowledge about existing products or to communicate needs and preferences regarding products [15][16][17]. Utilizing this approach and the information derived from UTAUT can be a powerful approach for analyzing these groups and to understand if they are a source of lead users.

To employ netnography for our purposes, there are four steps to follow: (1) making cultural entrée; (2) collecting and analysing data; (3) ensuring trustworthy interpretation; and (4) following research ethics and providing opportunities for member feedback [18][19]. Let's examine each of these steps in detail:

1) Entrée: Identify the group of interest
   a) For us it is the Grinders and Biohackers in situ with the http://forum.biohack.me for Grinders and http://www.longecity.org for the biohackers.
   b) The biohack forum is a perfect connecting place for experienced members to share their experience with new and curious individuals. Overall there are 1,986 different discussion boards covering topics of implants, genetic and biology mods, supplements and nootropics, haptics and wearables. For the purpose of observing the grinder subsegment we will be narrowing the scope to the 951 discussions regarding implants. This section of discussion has major topics around general implant info, magnets, RFID/NFC, coatings,

materials, charging and implant stories. For the Longecity website focuses "to conquer the blight of involuntary death" as their mission statement. The website offers four main forum topics: Bioscience, supplements, brainhealth, and lifestyle. For the research, three forums will be picked from these topics and looked into detail. From observing these forums we can evaluate the lead user characteristics of forum members based on years of experience, individual expertise and technology contributions.

2) Data Collection and Analysis: Direct data from the forums on the website and observational information.
   a) Observational information to be gleaned using the websites with direct data from forum posts.
3) Interpretation: Interpret based upon the limitations that these are observations from an online sources as opposed to real life consumers.
   a) Interpretational information to be gleaned using the UTAUT framework and the four determinants of Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating conditions.
4) Research Ethics and Member Checks: Inform community members of intent of research as well as providing any members interested with research text.
   a) Became members of the community and inform them of our intent of research.

After these steps have been followed, they can be applied to the six characteristics found in lead users: ahead of trend, dissatisfaction, product-related knowledge, use experience, involvement, and opinion leadership[20][21]. According to the research article of Belz et al, the community would display strong lead user potential if their members can demonstrate five of the six characteristics (with opinion leadership being the least critical). For the purposes of research and applying the netnography method in conjunction with lead user characteristics, the lead user characteristics are going to be broken out into "group characteristics" and "individual characteristics." The purpose of this is to find forums with the two characteristics of "ahead of trend" and "dissatisfaction" to help identify people with the remaining characteristics of "product-related knowledge, use experience, involvement, and opinion leadership" to identify lead users.

Group Characteristics

When considering the two groups at large they show the characteristics for ahead of trend and dissatisfaction. The grinders are experimenting with products that are not currently available on the open market. Many of these products are developed within the groups themselves and initial experimentation is on themselves. The biohackers experiment with different drugs and supplements that are available but not widely adopted and they use

them in ways to see reactions to different combinations of these supplements and drugs. They show the dissatisfaction of current markets or avenues for research because the secrecy of new found research from commercial entities and labs. Therefore they tend to be very open about what they find out and publish their results in such a manner that it s available to anyone. These groups have been driven to communities like this because the are dissatisfied with products currently available on the market. This is also an indication they are dissatisfied with the current progress in technology to bring this types of products into the market.

Individual characteristics

For our research we are considering the remaining four characteristics for determining lead users as individual characteristics to be observed and evaluated on specific individuals. The table below describes these four remaining characteristics in relation to these communities.

Product-related knowledge	Has a level of technical knowledge
Use experience	Have experimented on themselves
Involvement	Active user within the forums
Opinion leadership	Actively encourages others involvement and contribution

Table 2: Individual characteristics of lead users

Discussion board selection criteria

Both of the forums being observed for this research have a significant amount of content and different discussion boards. For this reason we have created a selection criteria to narrow the scope of discussions. For a discussion board to justify further evaluation they should have greater than 10,000 views with greater than 100 comments. A discussion board could also justify further evaluation outside of this criteria if it is discussing product feature scope, testing/trials or product viability review.

Data Collection from netnography

Grinders

When applying the selection criteria to the Grinders community found on Biohack.me we selected the following three discussions for further evaluation.

Discussion Title	Views	Comments	Contributors
Firefly Tattoos	27900	461	69
Bluetooth LE bone conduction implant	16800	115	25
How much would you pay for an implantable watch?	7600	33	16

Table 3: Discussions chosen from selection criteria for Grinders

"Firefly Tattoos"

The premise of the firefly tattoo discussion is about the idea of having glow in the dark tattoos. The method of producing this effect as described in the forum is to use subdermal implants made from tritium gas capsules. Tritium lights are used in watches, gun scopes and emergency exit signs. These standard products are safe to handle but due to the small amount of beta radiation emitted from the decay of the tritium gas, they are not safe for subdermal implantation as is. The forum discusses in depth the development to produce a safe package to make this technology biosafe for implant. The development of a lead oxide glass casing for radiation shielding while allowing light transmission along with a second coating to protect the body from the lead glass. The development also including the variations in light intensity for different colors which drove selection toward highest photon output. This showed an in depth working knowledge of the technology and potential risks associated with it by the discussion initiator and some of the discussion contributors.

"Bluetooth LE bone conduction implant"

The idea presented in this discussion is a bluetooth connected "earbud" implanted and mounted to bone similar to a cochlear implant but the target product to be very small size for consumers. The discussion covers product features, benefits and potential issues. Product features discussed throughout the conversation include rechargeability, bluetooth connectivity, integrated phone security, audio and voice. Works through group problem solving to discover better solutions. Considers multiple views of different potential users. The technological discussion present in this forum discussion shows a high level of understanding in regards to the technology being discussed. Also to be mentioned is that the initiator of this discussion had comments in the Firefly discussion.

"How much would you pay for an implantable watch?"

This discussion was created as a product concept survey about costing and desired product features. The discussion covers cost ranges, product dimensions, product features, charging methods, time between charge, overall product lifespan and implantation process.

This discussion did not meet the initial criteria for selection but because of the direct focus on product development it was decided to include it. This discussion had fewer comments and contributors than the first two but still had a reasonable level of technical discussion. The technology associated with this idea may not have been as advanced as radiation shielding or audio quality through bone conduction but it still required the use of inductive charging to produce a rechargeable product.

Biohackers

Utilizing the criteria previously established for the forums, we selected the following three discussions for further evaluation for the biohackers from the longecity.org website.

Discussion Title	Views	Comments	Contributors
Personalized Nutrition	22600	175	13
Alzheimer's	11900	150	26
Gene Therapy	24600	105	15

Table 4: Discussions chosen from selection criteria for Biohackers

"Personalized Nutrition":

The personalized nutrition forum that was reviewed showed a great depth of technical knowledge. The forum focused mainly on nutrigenomics and nutrigenetics for the purposes of having a genome sequencing to determine what genes are expressed or recessed and how that may have implications for nutrient malabsorption or deficiencies. Using these sequences with their personalized blood testing, they showed the potential for utilizing this knowledge to help control their personalized nutrition needs. They even expanded on the how this may be mass marketed by using smart phone app connected with servers or artificial intelligence to find how trends of genomes may be more at risk for certain diseases. By using blood tests like hematology, free fatty acids, free radicals and antioxidants along with their genome map, they showed great initiative to their knowledge, experience, involvement, and opinion leadership.

"Improvement in end stage Alzheimer's patient with Dnase1":

Dnase 1 is a medication that was initially used for cystic fibrosis patients that had been repurposed for a study on the altering of Alzheimer's. Dnase 1 is deoxyribonuclease I which is a DNA unraveller that is theorized to help clear plaques and tangles in Alzheimer's patients' brains to help cognitive function. What made this forum really interesting is the poster's interest in doing a "group buy". The idea behind a group buy is that they pool in

money to by a large quantity of drug from a lab that is willing to make it for them. The buy eventually fizzled out due to the difficulty in finding a lab willing to perform the work and the ability to have it tested by an outside lab but the characteristics of lead users was very evident.

"Gene Therapy and DNA repair":

The forum of Gene Therapy and DNA Repair was mainly a discussion of technical information of using vectors (viruses that target genes) to change genomes to cure diseases. They also went into detail discussing the use of microfluidics to contain unraveled DNA for diagnosing and testing. A vast majority of the posts were articles to swap knowledge and experience of the field. The involvement of the members stemmed from the reading and critical analysis of the papers they were discussing, though it would seem from the forum there was not physical experimentation of the subject. The lead users were probably the least expressed in this forum as the forum was used mainly for the purpose of technical knowledge and was more lacking on opinion leadership and physical involvement.

Analysis Results

The quantity of comments and number of contributors was analyzed and is presented in the graphs below. This shows the percentage of contributors that contributed a specific number of time in the discussion. As can be seen this resembles an exponential decay function with the majority of individuals contributing less than ten times. When we look out at the tail which was clipped at a >25 contributions point we find the individuals of interest. These individuals are contributing at high levels and generally with a higher level of technological experience. The initiators of the discussion board fall into this realm for the three examples in the grinder group and will be evaluated further. Two out of the three initiators for the biohackers group were the highest contributors as well.
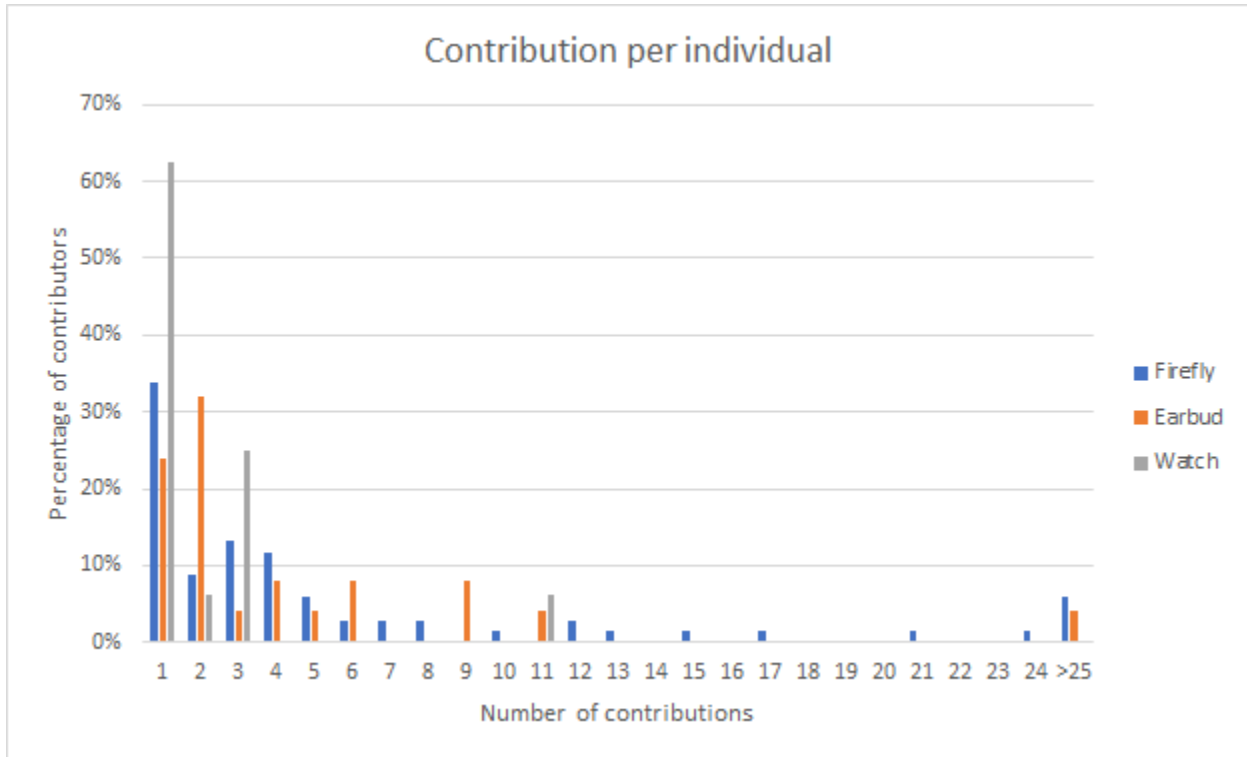
Graph 1: Results of Grinder discussion board contributors
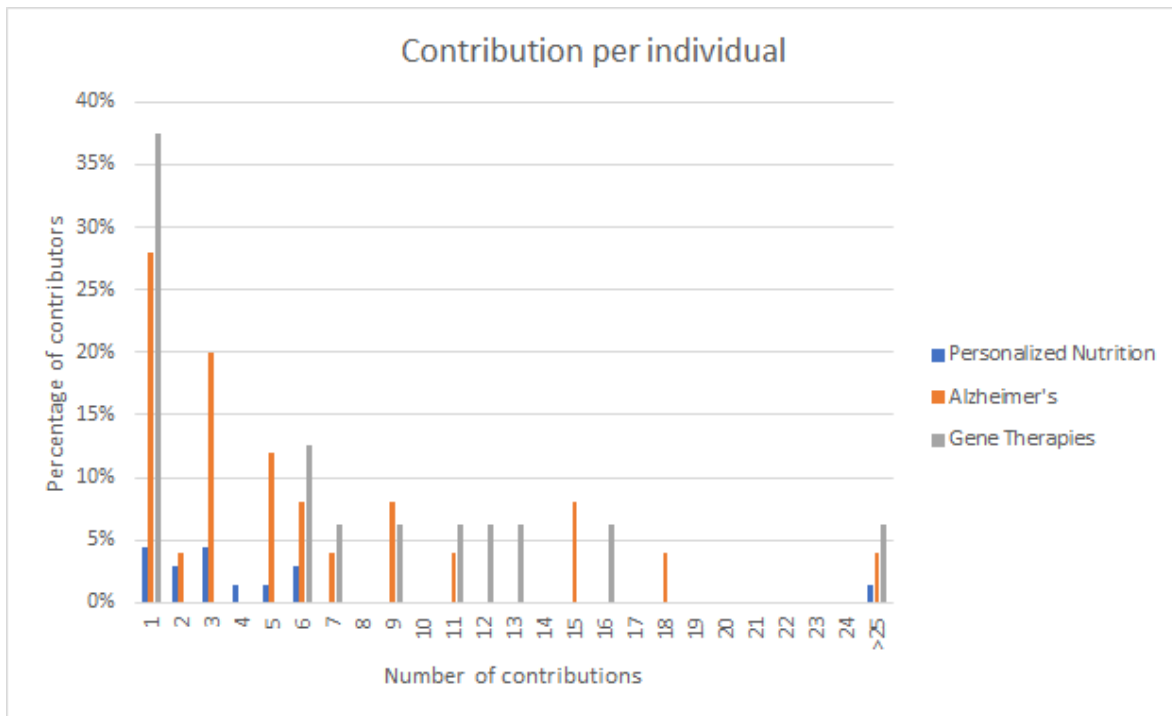
Graph 2: Results of Biohackers discussion board contributors

Grinders Lead Users

The initiators of the three discussions were the individuals with the highest comment count so they were chosen for further evaluation. Below are the results of further analyzing the individuals and their history within the biohack.me forum. To consider the level of involvement the individual has we consider the time they have been an active member, their overall comments and the number of discussions the have initiated. The basic fact that these individuals have been members of the forum for 2-3 years indicates a high level of involvement within the community. Their quantity of comments also leads us to believe they are opinion leaders within the forum and have a certain level of product-related knowledge that is useful in many discussion boards.

Discussion Initiator	Forum Join Date	Target discussion comments	Overall forum comments	Overall discussions initiated	Other
Firefly Tattoos	Nov. 2014	61	418	8	Forum Admin
Bluetooth LE bone conduction implant	April 2014	34	274	10	
How much would you pay for an implantable watch?	Feb. 2015	11	57	6	

Table 5: Grinder discussion initiators data

From the information in the above table and evaluation of the specific discussion content as well as historical comments by the individuals within other discussion boards we can create the table below. The final characteristic to be considered is the use experience. This was not as apparent from simply reviewing the immediate discussion board for two of the three discussions. The firefly tattoo initiator started out the discussion board with images of his experimentations on himself as well as raw chicken prior to self experimentation. The "Bluetooth LE bone conduction implant" and implantable watch initiator did not have as obvious a use experience. When digging deeper into the historical comments by these individuals though it was clear that they both had magnetic implants currently or at some point. This secured the final characteristic of use experience for all three individuals.

Discussion Initiator	Product-related knowledge	Use experience	Involvement	Opinion Leadership

Firefly Tattoos	X	X	X	X
Bluetooth LE bone conduction implant	X	X	X	X
How much would you pay for an implantable watch?	X	X	X	X

Table 6: Grinder Lead User Characteristics

Biohackers Lead Users

For the Biohackers, three discussions were picked based upon their initial subject of the forum as well as the two forum characteristics of ahead of trend and dissatisfaction. Two of the three groups expressed high marks for potential lead users, the other one did have lead user characteristics but the likelihood of being an opinion leader was more likely than a lead user. The three users that were discovered to have a lot of overall comments and have been involved in the forums from 7-15 years, which shows a high level of involvement. All are still active members. The forums to which they contribute do show a high level of technical knowledge, use, and involvement though some had more use and involvement than others. It is interesting to note that two out of the three lead users found were discussion initiators but one was not based upon overall comments from Graph 2. It had been noted in the tables below.

Discussion Initiator	Forum Join Date	Target discussion comments	Overall forum comments	Other
Personalized Nutrition	Oct. 2010	129	1128	
Alzheimer's	Aug. 2002	30	8080	
Gene Therapy*	Jan. 2003	30	2770	Lifetime Member

*Not initiator, lead forum commenter
Table 7: Biohacker discussion initiators data

From the netnographic methods employed and looking at the contributors themselves, a qualitative table was generated below to display the potential lead user characteristics from these forum posters. The users from the Personalized Nutrition and Alzheimer's forums showed the four characteristics examined for lead users but the user for Gene Therapy did not. They lacked Use and Involvement characteristics but are still shown to be potential lead users having amassed four of the six user characteristics.

Discussion Initiator	Product-related knowledge	Use experience	Involvement	Opinion Leadership
Personalized Nutrition	X	X	X	X
Alzheimer's	X	X	X	X
Gene Therapy*	X			X

*Not initiator, lead forum commenter

Table 8: Biohacker Lead User Characteristics

Results Overview

These two groups (Grinders and Biohackers) have some individuals that are highly committed with their believes, they are constantly participating in these forums to share their knowledge, receive feedback and help the community explore further their ideas. Most of the time they are the initiators of the discussions trying to get some insights from the community and develop their ideas deeper.

We decided to choose three individuals in each of these sub-groups and evaluate them into the lead user behaviour. They (Grinders and Biohackers) are doing this because there is something in the current market that does not satisfy their needs, they are ahead of trend because there is nothing available in the market similar to the products they are looking for. Moreover, they have a high level of knowledge, experience and involvement that they want to use to motivate the community by creating new discussion topics in the forums.

As a result we determined that we can describe them as strong lead users, because they fall into all the categories. Moreover, the method we used to identify the lead user behaviour may also help when trying to find opinion leaders. This information could be potentially used for future product ideas and product development

Conclusion

In conclusion of this research, the method developed can be used to discover lead users and opinion leaders within these dominantly online subgroup communities of the transhumanist movement. But why do we care? While the methods and experimentation may seem extreme to most of society, they could be sources of potential future products.

It is unlikely that a majority of the population will start getting magnetic implants in their fingertips or placing experimental electronics under their skin. On the other side though it was once considered socially extreme to get tattoos or piercings and they both are quite common now. Could the next evolution of personal expression using the body be glow in the dark tattoos or implants? This is very possible. While people will not be

jumping at the opportunity to get implants in their skulls for audio connect we can already see earbuds getting smaller and maybe one day being unseen deeper in the ear like a hearing aid. These groups may be experimenting with the next generation of features that could be found in these developments. The biohacking forums which were discussed in the previous sections also reveal possible commercial products. One which was mentioned was the use of AI and servers to help diagnose genome nutritional requirements and disease diagnosis. Another is utilizing not widely available drugs to help treat disorders through group buy-ins, it could very well be they are onto something and could lead to more research and testing for under utilized drugs.

In the end we believe these groups have a need and are experimenting to find a solution ahead of social phobias and outside of government restrictions. Any companies working in these industries should take notice and keep track of these communities as they may be developing the next revolution in their respective fields.

Image 1: Firefly tattoo images. biohack.me

Limitations and future research

In our research process we identify multiple factors that could have affected the final results and in this section we will explain why these should be considered in any future research.

One of the limitations was the method we used to gather data. We manually went into the forums to identify: who was the initiator of the topic, who were the people that had the most comments, what type of comments were they making, how many people were actively participating in the discussion and any other relevant information that we could find by looking at these forums. The results we got were manually noted and they depended 100% on our evaluation criteria. For future research in this topic, we think that the use of a software to evaluate individuals in online forums should be necessary to obtain results that

are highly accurate, faster to analyze and it will help the researcher to avoid having any type of biases in the results.

The second limitation we had was the amount of sources we used to choose the forums (biohack.me for Grinders and longecity.org for Biohackers) due to the amount of time we had to create this research paper. More sources should had been reviewed in order to be able to see what are the different characteristics between people using different sources and identify if they behave the same way. We also used a limited sample size (3 forums), but we think that a bigger sample number will be necessary to evaluate the validity of this methodology and it will also help to expand the conclusions and potential information for new product ideas.

The results we obtained were based on our subjective evaluation to identify the correlation between the lead users characteristics and forum initiators, this could change based on the evaluators criteria. The same situation happened when trying to differentiate between lead users and opinion leaders, because all the results depended on the evaluators' criteria. We think that for future research on these topics a new methodology needs to be created to clearly identify and differentiate between the lead users and other types of users (Forum initiators, opinion leaders, etc…).

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