

GROUNDING THEORY OF FLORIDA AQUARIUM RETAILERS'
ACCEPTANCE OF THE GLOFISH

By

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To my wife, Susannah, in memory of her father,
Phillip Herndon.

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I thank my supervisory committee, my wife Susannah, my parents, Edward and Pat, and the ornamental fish retailers who participated in the study.

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GLOSSARY OF TERMS

Category: The highest level of code organization.

Code: The lowest level of organization of a transcribed interview.

Coding: The process of assigning codes to words, paragraphs, and sentences of transcribed data.

Constant Comparative Method: A process used in Grounded Theory to retroactively compare the participant responses to interview questions.

Coordinated Framework: The grouping of government agencies (USDA, FDA, and EPA) tasked with regulating genetically modified organisms.

***Danio rerio*:** Scientific name of zebra danio

Economic Cognitive Model: Model that explains the aquarium retailers' reaction to the GloFish™.

Family: The second level of organization of transcribed data.

Gene Construct: A series of genes.

Genetic Marker: An indicator used to mark either the presence or position of a transgene.

Genetically Modified: An organism having a genome altered.

GM: Genetically modified

GMO: Genetically Modified Organism

Grounded Theory: A qualitative inquiry that constantly compares the patterns of responses among participants.

Hierarchy: The organization of the data from the lowest level, codes, to the most sophisticated, categories.

Jurassic Park Effect: Phenomenon resulting in fear that contains two parts: trust and perceived consequences of an action.

Network: Explanation of relationships among codes or categories.

Product Attribute: A characteristic that makes a fish or other product more marketable and desirable to the consumer.

RFP: Red Fluorescent Protein: Genetic construct coding for the production of red colored protein.

Saturation: A qualitative term when the researcher has heard all possible responses to the structured interview questions.

Segrist Farm & 5-d Tropical: Two aquaculture facilities who breed the GloFish™.

Structured Interview: An interview where the questions follow a fixed list of questions.

Theme: The first level of organization to emerge from the grouping of codes that is rapidly replaced by families.

Transgenic: An organism containing foreign genetic material.

Yorktown Technologies: Austin Texas based start-up that owns the intellectual property rights to the GloFish™.

Zebra Danio: The common name for *Danio rerio*

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This research was undertaken to understand Florida ornamental fish retailers' responses to the GloFish™ exemplified by their decision to stock or not to stock the fish. Twelve interviews were conducted over a 16-month period. Interviews continued until saturation and a substantive theory, the economic-cognitive model, was developed. The constant comparative method was used to examine the responses among all previous participants before subsequent interviews were conducted. Saturation was reached rapidly due to the homogeneity of the population of inquiry. Four categories containing more than 150 unique codes were created from the transcribed data. Codes were organized into themes, then families and ultimately categories.

These categories emerged: product attributes, economics, ethics, and the Jurassic Park effect. The response of the retailers was simplified into their stocking decisions; the decision to stock the GloFish™ used all aspects of the manifested categories. First, the retailers' perception of the GloFish's™ value was captured by the product attributes category. Color, price, personality, and survivability, respectively, were the most valued product attributes. Second, there was considerable dialog about the profitability, margins, and cost of the fish which was placed in the economics category. This category was the most influential in determining retailer

stocking decisions. A third category emerged from the transcribed data, ethics. While economics was the driving force behind stocking decisions, ethics served as a stop-gap since retailers would refuse to stock transgenic fish regardless of economic gain. Lastly, the Jurassic Park effect, a fear-based phenomenon created by lack of trust in humanity and perceived consequences influenced retailers' responses. The effect was ancillary, but it could strengthen or weaken retailers' responses.

The reaction to the GloFish™ was multifaceted, and drew from a diverse group of categories which were ultimately governed by ethics and perceived economic value. Color was the primary product attribute customers wanted, but several retailers refused to stock the fish despite its intense coloration because they believed it was morally wrong to genetically modify a fish to make it more marketable. The research indicates that when new technologies are released to the public, there is no simple formula to predict the public's response. However, if there is both economic benefit and no ethical complications, then the likelihood of a positive response would be high.

CHAPTER 1 INTRODUCTION

The transgenic zebra danio, or GloFish™, represented the first attempt by the private sector to capitalize upon a transgenic animal for public use. The GloFish™ was born in the late 1990s when researchers led by Dr. Zhiyuan Gong at the National University of Singapore began experimenting with zebra danios to monitor water quality in coal mines (Gong et al., 2003). The concept was to create a fish that would fluoresce in the presence of toxins, and then return to normal coloration in clean water. Scientists were able to successfully incorporate new genes coding for the production of colored proteins into the fish's genome, but they were not successful at inhibiting the production of the protein, leaving the fish permanently colored (Gong et al., 2003)

In 2001, Yorktown Technologies, a Texas based aquatic biotech start-up led by Alan Blake and Richard Crockett realized the potential to market the colorful danio in the United States and entered into a licensing agreement with the Dr. Gong. By 2001, Yorktown Technologies began selling a genetically modified ornamental fish under the name GloFish™. The fish is the first in a pipeline of third generation biotechnologies derived from not only plants, but animals, that will have significant social benefits (Marshall, 2006).

The rapid penetration of the GloFish™ into the ornamental fish market can be attributed to two factors: the prevalence of nongenetically modified (non-GM) danios in aquarium stores, and the simplicity and prevalence of the transgene in genetic research. Almost every aquarium store retailing tropical fish sells the non-GM variety of zebra danios. Fluorescent protein constructs, a genetic sequence that codes for the production of fluorescent proteins, appear in a multitude of molecular biological applications as genetic markers (Tsien, 1998; Zhang, Campbell, Ting, & Tsien, 2002). The construct is inserted along with other genes to ensure that the transformation

has occurred successfully. Another marker, resistance to erythromycin, can be used to determine if the desired transgene had been successfully incorporated, but Red fluorescent protein, RFP, constructs are considered more environmentally friendly, and do not require an additional culture step. Agricultural biotechnology has used fluorescent protein constructs for the development of golden rice, round-up ready soybeans, and Bt-corn (Lippincott-Schwartz & Patterson, 2003).

The nongenetically modified version of the zebra danio is stocked by many research institutions as well. The research community uses danios in a variety of capacities due to the fish's fecundity, resilience, hardiness, and genome. Research institutions have begun to replace mice and other warm blooded invertebrates in their labs with danios.

Globally, the two most significant barriers to the agricultural biotechnology industry are environmental risks and waning public opinion (Kearney, 2002; Lewis, 2001). As a subgroup of agricultural biotechnology, the factors that will determine the success of transgenic ornamental fish parallel genetically modified foods. Yorktown Technologies received significant public resistance spearheaded by special interest groups. The company's long-term success lies in its ability to market transgenic fish to such large retail chains which control the majority of the aquarium hobby market.

While several transgenic food fish have been proposed for commercialization, the Food and Drug Administration (FDA), the agency tasked with agricultural biotechnology governance, has never given approval for the commercialization of any genetically modified food fish despite a 12-year wait. On December 9, 2003, the FDA released a succinct statement to the effect that it would not regulate the GloFish™ since many of the same concerns that plague food fish transgenics, such as allergenicity and environmental degradation, were not applicable (Appendix A; FDA, 2003).

The most common concerns voiced by special interest groups and entities opposed to genetically modified fish were environmental. Environmental groups opposing the genetic modification of aquatic species include the Friends of the Earth, Green Peace, and the Sierra Club. The possibility of natural stock depletion and contamination with transgenic genetic material through escapee breeding concerned many scientists (Kapuscinski & Hallerman, 1991; Pew Initiative, 2003; Muir & Howard, 1999; Vandenberg, 2002). Unlike transgenic salmon, millions of nongenetically modified danios have been sold by the aquarium industry for decades, and only two instances of wild populations have been reported (Fuller & Nico, 2003). In addition, the temperature tolerance and fecundity of the transgenic species has been reduced.

Finally, there has been considerable public concern over the reasons for genetic modification. Ethical concerns pertain to unnecessarily using the technology to create organism that offer minimal social benefit beyond aesthetic enjoyment. Since the GloFish™ was originally created for biomedical and environmental research, many of the ethical concerns are mitigated. A percentage of all the GloFish™ sales return to the researchers in Singapore to aid in the development of vaccinations and other genetic research. Already the same laboratory has used the proceeds to develop an oral Hepatitis B vaccine.

Aquatic biotechnology, specifically the creation of transgenic fish, constitutes the “bleeding edge” of the broader agricultural biotechnology sector. Under the umbrella of biotechnology, scientists have been experimenting with zebra danios for two decades. Presently, the United States leads the world with the number of patents for aquatic species, but other nations are quickly realizing the benefits of working with fish for developing bioreactors and improving broodstocks for their food aquaculture sectors (U.S. Department of Agriculture [USDA], 2004). Few countries have regulatory frameworks in place to govern the technology;

the countries with the most to gain, however, also have the most to lose. In Asia, few or no governance protocols are in place to protect the industry from abuses that could taint the sector globally. Unfortunately, countries that would benefit most from improved broodstocks lack safety nets that are in place in the developed world.

The introduction of the first GM animal in the market sets a new precedence for biotechnology and was the first instance, outside of biomedical advancements, wherein a genetically modified product has been geared towards consumer's desires rather than producer's needs. The GloFish™ experienced widespread media attention. The reaction of aquarium fish retailers to the new products constitutes an opportunity to examine the public's acceptance of next generation biotechnologies

In 1999, Florida's aquaculture products totaled \$86 million. Tropical fish accounted for more than 50% of the total dollars, followed by clams and aquatic plants (Hodges et al., 2001). The total figure dropped to \$75 million in 2005, with a decrease of \$10 million in the farm-gate value of ornamental fish (National Agriculture Statistics Service [NASS], 2006). While the ornamental fish industry is vital to Florida's aquaculture sector, the decrease in the number of farms from 151 to 133 has been attributed to softening in demand in addition to an active hurricane season in 2004 (NASS, 2006). Most ornamental fish farms are family owned and operated; however, some larger corporate farms, including Seagrist and 5D, dominate the market (Hodges, Mulkey, Philapakos, & Adams, 2001). In the United States, 12 of the largest farms account for 60% of sales (NASS, 2006). Unfortunately, the dropout rate for hobbyist is high (Tulloch, 2003). While the number of people keeping aquarium fish has risen in the last few years, pressures to innovate and develop more exotic breeds of fish are intense (Lass, 2004).

The GloFish™ derived from zebra danios, a staple in any aquarium store. The GloFish™ represents the most technologically advanced aquarium organism and holds promises both for revitalizing the ornamental industry and creating more environmentally friendly and efficient broodstocks for aquaculture. Before the GloFish™, new ornamental fish were introduced from wild stocks obtained via invasive netting techniques that had deleterious consequences for delicate tropical ecosystems (Gerstner, Ortega, Sanchez, & Graham, 2006).

Globally, both aquaculture and agriculture biotechnology are under scrutiny by special interest groups. The Center for Food Safety, Friends of the Earth, GreenPeace, the Sierra Club, and PETA all oppose aquatic biotechnology (Center for Food Safety, 2004; Friends of the Earth, 2004; Sierra Club, 2004). Already, poor public perception of transgenic agriculture products in Europe has reduced the research dollars allocated to developing new strains. Unless the aquaculture industry works in unison with the scientific community to monitor the public's perceptions, attitudes, and beliefs about genetic engineering, aquatic biotechnology may never deliver its promises. Canada, China, Europe, Cuba, and the United States have all made significant advances in aquatic biotechnology, but their research will be buried as long as the sector fails to address public sentiment.

Publications addressing transgenic ornamentals, specifically the GloFish™, have been reports rather than research. While there has been considerable qualitative work examining the public's reaction to the broader biotechnology sector, there has been no research specifically addressing transgenic ornamentals (Pardo, Midden, & Miller, 2002; Pew Initiative, 2003; Phillips & Corkindale, 2002). Articles from special interest groups such as Greenpeace and Center for Food Safety appear in online searches of the web, but lack rigorous methodology, and

are based on parallel studies by Howard and Muir (Center for Food Safety, 2004; Greenpeace International, 2004; Muir & Howard, 1999).

A qualitative study of the GloFish™ was needed since numerous controversial technologies will be marketed and capitalized in the near future. Researchers must consider resistance to these technologies as part of their development (Bauer, 1995/1997b). The human response to third generation biotechnologies will drive industry's decisions on what technologies are worthy of investment. The results of the research are applicable to products outside of the biotechnology arena that the public perceives as dangerous. No theory has been developed to explain why retailers either choose to reject or accept products created using the controversial technology.

CHAPTER 2 MATERIALS AND METHODS

Statement of Purpose and Research Questions

When the GloFish™ was introduced, there was a unique phenomenon where some retailers wanted to be the first to offer the fish to the public while others refused to stock it. The public outcry that occurred when the product was first introduced in 2001, political maneuvering, and a strong avoidance of the GloFish™ by some aquarium retailers needed to be examined. The response did not align with other theories, so a new model needed to be developed. Grounded theory methodology provided a framework to develop a model using interviews with industry stakeholders.

Research Questions

The research questions answered by this study were the following:

- How do aquarium retailers perceive transgenic ornamental fish?
- Why have some aquarium retailers refused to stock the product while others have been eager to purchase the GloFish™ from their supplier?
- What decision making processes do retailers employ to stock new controversial fish?
- What characteristics of the GloFish™ do retailers find either attractive or unattractive for their customers?

The research questions proposed in this study were ontological and epistemological.

Ontological questions seek to define the objects of inquiry that explain theory and seek to address why actions are performed (Anderson & Baym, 2004). Examples of ontological questions from this research included why researchers were developing this technology, why this topic was proposed, and why people have developed the opinions that they have developed.

Ontological questions address why we are examining the phenomenon of rejection or acceptance of transgenic fish is being conducted. Ontology is the branch of philosophy that deals with

knowledge. Ontological theory describes the knowledge people have about transgenic ornamentals. Biotechnology surveys address the ontological component by measuring the knowledge that people have on the issue, but do not ask how or why that knowledge exists. Examining only the ontological aspect of why retailers' rejected the GloFish™ would have provided a one dimensional view of the phenomenon.

Epistemological questions address how we know what we know, such as how opinions and attitudes develop, and how we come to understand what is around us. Epistemology is the branch of philosophy that addresses how we know what we know. For this research, epistemological questions addressed how the stakeholders came to develop their views on transgenic ornamentals.

Qualitative Methods: Grounded Theory

A qualitative research methodology was superior to develop the theory for the following reasons. First, there had never been a qualitative inquiry to develop a model that would explain the public's reaction to transgenic ornamental fish. The population of aquarium retailers held a wealth of information that was not being investigated. They had the advantage of interacting with both consumers and producers which provided input into their attitude and knowledge formulation. Second, since no previous research existed, creating instrumentation would have been difficult since the ranges of responses were unknown. A survey would have required a basic understanding of the existing range of opinions to ensure high content and construct validity. Without qualitative inquiry, the theoretical constructs would have been based on assumptions rather than data. Third, to fully understand the range of opinions and emotions, fieldwork had to be conducted. The emotions and opinions examined by this research were rooted in their contexts and disclosed, since unknown context specific variables might have influenced the data. Quantitative research would have overlooked valuable information and

could not have provided rich description of the context. Fourth, quantitative research would have biased the responses by creating an unrealistic control environment that bound the responses by predefined constructs. Using an instrument with attitude indices would have failed to examine how or why the attitudes were formulated. The range of responses led to the development of substantive theory since it tested the instances when the theory failed. Finally, participant responses were systematically examined and explored rather than taken at face value. Inductive reasoning was necessary to explore aquarium retailers' responses to the onset of transgenic fish.

Among the qualitative research traditions, grounded theory was the best choice for the following reasons. First, it allowed the researcher to develop a model, the desired end-product of the research. Second, it did not require a bounded system such as a case study. Third, the methodology assumed that knowledge can be built from interviews and observations, and while it was context specific, it could be used to build a transferable model. Other research methodologies could be used to answer the research questions; however, grounded theory provided the most holistic approach.

Grounded Theory Styles

While the original form of grounded theory is Glaserian-Strausian, the researchers evolved their methods over time (Glaser & Strauss, 1967/1999). Subsequently, Corbin and Strauss published more structured methodological tools such as *Basics of Qualitative Research* in 1998 (Strauss & Corbin, 1998). The Corbin–Strauss combination provides more rigor and fixed instruction, while Glaser became more emergent and less structured (Walker & Myrick, 2006). The methodology used for this research resembles more the methods of Corbin and Strauss rather than a Glaserian study.

Statement of Purpose

The purpose of this grounded theory study was to understand the responses of retailers in the ornamental fish industry to the onset of transgenic products. The central focus was to obtain local ornamental retailers' opinions about new ornamental fish developed with biotechnology and to come to understand the basis of their initial disapproval or acceptance of such products and what contributed to a shift in mindset if one took place. (Creswell, 1998)

The theory developed by this research elucidated the public's impetus to prevent the capitalization of new biotechnologies. Grounded theory methods generate two types of theory, substantive and formal. The resulting model constitutes substantive theory since it addressed the rejection of the technology by retail pet stores (Glaser & Strauss, 1967/1999).

Sampling

For grounded theory research, a population of interest must be isolated that has the characteristics that will lead to the development of the theory. For this research, the population Florida aquarium retailers, were selected as the population based on availability, proximity, and contact with the end customer, the aquarium hobbyists. For nonsocial scientists this step appeared to violate the scientific method and reduce generalizability. Rather, the selection of the right participants was fundamental to the development of the theory since it isolated the sector of the population deciding to stock or not stock the GloFish™. A wide range of aquarium retailers were interviewed, from strictly marine to strictly freshwater. The purpose of the sampling was to maximize the differences among the participants.

The sampling approximated the theoretical sampling techniques described by Glaser and Strauss (Glaser & Strauss, 1967/1999). Purposeful sampling was done from a pool of aquarium retailers in Florida using the Yellow Pages™ Online. Aquarium stores in Gainesville, Tampa, Jacksonville, Ocala and Orlando were asked to participate in the research. Subsamples were

created based on metropolitan area, and all participants from their respective metropolitan areas were interviewed before moving to the next location. The order of the sampling was Gainesville, Ocala, Jacksonville, Tampa, and Orlando. Interviews were conducted until saturation was reached which occurred after 12 interviews. Since Orlando was the last location, not all aquarium retailers were interviewed since saturation had been reached.

While Creswell estimated that approximately 20 interviews were generally required to reach saturation, fewer interviews were required due to the homogeneity of the aquarium retailers in Florida (Creswell, 1998). As well, numerous grounded theory studies indicated that saturation could occur after less than 15 interviews (Becker & Stamp, 2005; Mostafanejad, 2006; Wiitavaara, Lundman, Barnekow-Bergvist, & Bruline, 2007; Wisdom & Agnor, 2007). Due to the variance within the participants, transferability, the ability to apply the findings to other instances, should be high. However, as a percentage of total sales generated in Florida, the 12 participants probably represented less than 10%.

The next step, coding, required the researcher to analyze the differences among the participants' responses to the interview questions. The categories became apparent quickly, and sampling continued based on geographic location. When all the retailers in one area had participated, a new metropolitan area was targeted. As the categories became populated and saturated, the researcher verified the common appearance of the categories by maximizing the diversity of the participants. This step contributed to the reliability of the study. The final result of this process was a new theory explaining the reluctance of retailers to purchase and sell the GloFish™.

Implementation

The first step was to contact retailer stores via telephone and inquire if they would be interested in participating in the current research. An interview time and location was

established for those agreeing to participate. Out of the 12 interviews, 10 were conducted at the participants' places of business, one at a restaurant, and one at a conference room at the University of Florida. Four interview protocols were developed during the course of the research (Appendix B). Given the emergent nature of grounded theory, interview protocols evolved from subject to subject. All interviews were digitally recorded in MP3 format and fully transcribed by a professional transcription service, M.R.T™ services in Atlanta, Georgia. Turnaround time per transcription was two weeks. ATLAS.ti™ software was employed to code, organize, and help the researcher analyze each interview. The program allowed the researcher to look across all previous interviews simultaneously as well as creating hierarchies and networks. The software allowed the researcher to examine groupings of data among all the interviews simultaneously, but did not perform any analysis.

A preliminary pilot study was conducted in Gainesville to ensure that the structured interview functioned properly and that the correct questions were posed. The results from the pilot study were used to evolve the interview protocol, and served as a general litmus test to the efficacy of using grounded theory to investigate the phenomenon.

The transcribed interviews were imported from Microsoft Word™ into ATLAS.ti™ and each sentence was assigned a code. The transcriptions were separated by numbered paragraphs which contained groupings of sentences.

Data was organized by codes, themes, families, and categories which evolved from interview to interview. Codes were located at the bottom of the data organization hierarchy. Open coding was completed on the first interview, and fewer additional codes were added with each subsequent interview. Throughout the process the relevance of each unique code was examined and, when possible, similar codes were blended. Initially, groupings of codes were

placed into themes. The creation of themes provided the researcher with a preliminary framework to organize types of codes before either enough data existed to group codes into families or the relevance of a group of codes could be determined. Preliminary families began to develop by interview 3, but were more clearly defined after interview 5. Finally, the highest rung in the hierarchy, categories was developed to explain the GloFish™ phenomenon. Categories transcended code groupings and had boundaries that appeared in the families and codes. The creation of categories involved both inductive and deductive reasoning.

Strengths and Weaknesses

The key strength of the research is that the data drove the development of the theory, which is rooted in the interviews via a traceable line of reasoning. Unlike other forms of qualitative research, the methodology used a rigorous comparative technique to enhance the transferability of the findings. The evolution of the model is clear and the conclusions are based on reasoning.

Some weaknesses of the methods included the reliance on verbal communication conveyed in the interview process. There was an overwhelming reliance on the interviewer to communicate clearly and to interpret the responses correctly despite perceived inconsistencies between intended and actual beliefs. While considerable time and thought was spent during the coding process and the development of interview questions, it was difficult to minimize the impact of the researcher on the participant. There was the influence from the Hawthorne effect (Mayo, 1933). Wherein, the presence of the researcher during the interview and the setting had a profound influence on the accuracy of the emergent theory. Selecting the environment and understanding the researchers' impact on the accuracy of the responses was addressed in the coding and analysis of the interviews.

Quantitative research would have had some benefits. First, the results from the survey would have been generalizable. Unlike grounded theory, inferential statistics could have been used to explain how the public perceived transgenic technologies. Second, survey research could have been done more rapidly and the data collection from all the participants would have taken place simultaneously rather than as an iterative sequential process. The grounded theory method was highly time intensive and required the researcher to revisit hundreds of pages of transcription to draw conclusions from later interviews. The cost of each interview was over \$350.00 after the payment to the participant, transportation costs, and transcription fees. Survey research is less expensive, can be performed quickly, and the results are returned and analyzed simultaneously.

Research Design: Quality, Reliability, and Validity

Of the eight techniques Creswell suggested to enhance the quality of the research, six were used by the researcher (Creswell, 1998). The two tools that were not employed were member checking and paid external auditing. Lincoln and Guba (as cited in Creswell, 1998) contended that member checking would be integral to the credibility of the study. However, member checks were not performed in this research since the questions were context specific and heavily influenced by mass media. Creswell also suggested hiring external auditors to validate the findings. Paid external auditors were not employed in the research due to cost and time constraints.

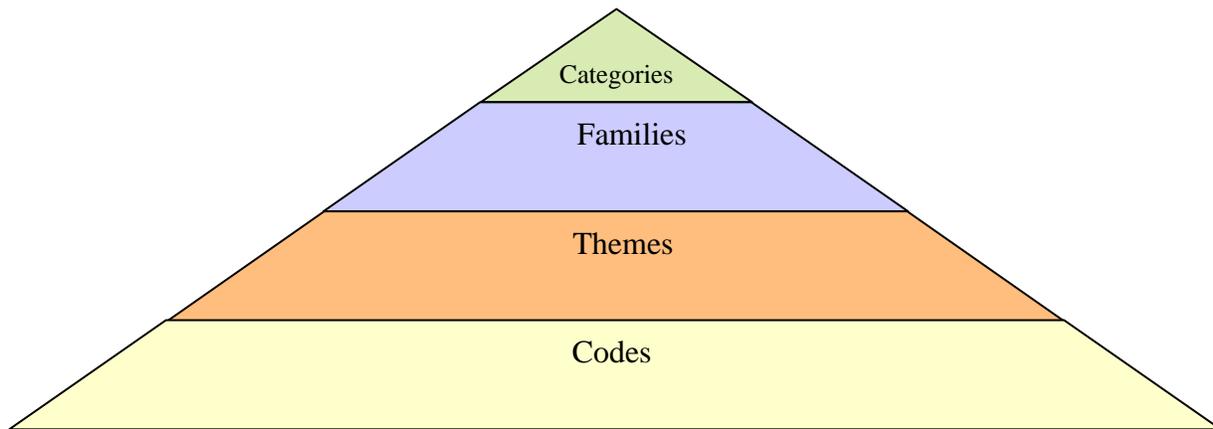
Six of Creswell's suggestions for improving quality were integrated into the research. First there was extensive time spent conducting the interviews and engaging with the participants. Each interview was 45 minutes, while approximately 40 hours were spent on coding and analyzing each interview. Over 150 pages of transcribed interview data was used to anchor the model. Second the findings were triangulated with several sources. Third, the final

model was peer reviewed by representatives from a variety of schools of thought and paradigms. Feedback was received from the departments of Agricultural and Biological Engineering, Journalism, and Food and Resource Economics. The peer review provided a forum for the researcher to strengthen the trustworthiness of his findings as well as interact with peers sharing similar research interests. Fourth, negative case analyses were completed to test the boundaries of the emergent theory. Disconfirming evidence was used to modify and evolve the theory to explain as many cases as possible. Fifth, the researcher clearly stated his biases and sought to minimize them during the interview process. In addition, he provided the reader with extensive self introspection and reflexivity in the narrative. Sixth, rich description was provided to capture a detailed snap shot of the interviews and their analysis. As many details as possible, and all the reasoning used to arrive at conclusions, were included in the narrative.

Several additional steps were taken to improve the quality of the model from Corbin and Strauss (1998). The “validity, reliability, and credibility” of the data was scrutinized. Second, judgments were made on the face validity of the theory development from the data. Finally, the reasoning employed to draw conclusions and build the theory was evaluated in the narrative.

Ethical Considerations and Publication Concerns

Risks to the participant were minimal. Measures were taken to ensure anonymity since the transgenic debate had become heated in a number of instances. Participation in the study was anonymous since some retailers had concerns about potential demonstrations and acts of vandalism against their stores if they sold the GloFish™. Finally, informed consent forms were provided, and the participants received fair financial compensation for their time.



Categories: Highest level of organization that emerged when the research had adequate data collected to identify nuances among responses to interview questions.

Families: Mid-level organization of codes and themes that identified preliminary patterns of responses to interview questions.

Themes: Grouping of codes.

Codes: Lowest level of organization assigned to sentences and words.

Figure 2-1. The coding hierarchy

CHAPTER 3 LITERATURE REVIEW

Qualitative Research

Theoretical Framework

Qualitative and quantitative researchers differ philosophically; one believes that the world has one truth while the other believes there are multiple meanings of the same truth.

Quantitative research resulted from hundreds of years of work translating phenomena into numerical representations of the real world. Ultimately, the two paradigms have contrasting underlying assumptions regarding how truth can be known, how measurement is taken, and how knowledge is generated. According to Creswell,

Qualitative research is an inquiry process of understanding . . . that explores a social or human problem. The researcher builds a complex, holistic picture, analyzes words, reports detailed views of informants, and conducts the study in a natural setting. (1998)

Qualitative research is multidisciplinary, drawing from psychology, sociology, education, journalism, and many other schools. Among these schools, there are frameworks including positivism, postpositivism, and postmodernism which determine the relationships between causality and research methods. Positivism is rooted in the scientific method and performs research to describe a phenomenon and is not qualitative (Anderson & Baym, 2004). Positivists believe that what can be observed and measured can describe the phenomenon. Postpositivists, however, acknowledge that all observations are fallible, and therefore the results from research are not causal. Postpositivism sees a hypothesis as probable until it can be debunked (Denzin & Lincoln, 2003). Finally, postmodernism challenges the concept of knowing and knowledge. It employs multiple modes of understanding to arrive at an outcome based on multiple meanings and interpretations (Cornell, 2005).

Positivism, the idea that the world could be measured and knowledge generated from the measurement instruments represented the philosophical foundation for hard science. Beginning in 1907, the Vienna Circle, made up of scientists, mathematicians, and philosophers, analyzed the creation of scientific knowledge to assess its accuracy given the fallacies of an unknown world (Byrant & Miron, 2004). The Vienna Circle birthed the concept of Logical Positivism and proclaimed that knowledge can only be generated from two sources: logical reasoning and empirical experiences. According to the Positivists, empirical experiences are the only fodder for scientific theory (Byrant & Miron, 2004).

Likewise, qualitative researchers ground themselves in a variety of other philosophical paradigms that debunk positivism. From a postpositivistic perspective, there is not one truth, but many which can be known through non-empirical measures. For postpositivists, reality can be approximated but if more perceptions of truth exist, then the better our understanding of the truth. Postmodernism goes a step further and questions the fallacy of creating knowledge. Ultimately, the philosophical foundations governing how reality is known determine how researchers measure phenomena and develop instrumentation. Qualitative researchers rely neither on empirical measures nor representations of abstract phenomenon to build knowledge (Byrant & Miron, 2004).

Qualitative researchers refuse to conceptualize world in data (Pauly, 1991). As well, the results are context specific and the researcher is an integral part of the process. Likewise, quantitative researchers based in a Positivistic paradigm view the world solely in terms of data and strive to reduce error while enhancing validity and reliability by employing the scientific method. The quantitative scientist is independent of the research and variables can be held constant. Quantitative researchers have an outside or etic perspective, and are impartial to the

results, while the researchers' perspectives in qualitative research are emic; they are part of the research (Cornell, 2005).

Qualitative research can build theories and models while quantitative research must test theories using the scientific method. Rather than prove or disprove a hypothesis, qualitative research describes phenomena without using either inferential or descriptive statistics. Through an analysis of field work, qualitative researchers use inductive reasoning to reach their conclusions. Quantitative research relies on minimizing error through experimental design to measure the phenomenon based on preexisting constructs. Quantitative researchers employ deductive reasoning to either reject or fail to reject the null hypothesis. The product of qualitative research is description rather than abstract text (University of Connecticut, 2005).

Qualitative research is based on the premise that researchers cannot explore phenomena with preexisting constructs. From a qualitative paradigm, predefined constructs cause researchers to reduce the range of responses and bias the results. Qualitative research strives to capture the richness of the context and uses detailed description rather than numeric data to explain a phenomenon. Finally, qualitative research views the world as having multiple meanings. For qualitative researchers, there can be multiple truths rather than one immutable truth that can be empirically known. Underlying quantitative measurement, prediction, and control is the idea that there is one truth that can be known (Creswell, 1998).

The Challenge of Social Scientific Research

Several aspects of the social sciences make generating theory and conducting research based on empirical experiences difficult. First, according to social scientists, knowledge is constructed rather than measured. Second, social phenomena are rooted in a context; removing the context changes the outcome. Third, social phenomena are not repeatable since all aspects of

the context are subject to change and cannot be held constant. Finally, emotions, feelings, and nonempirical experiences become bounded by the instruments used to measure them.

Measurement allows for the development of instrumentation, data collection, and analysis. Instrumentation allows scientists to share and build perspectives. To measure a social phenomenon, however, requires researchers to construct knowledge and reality based on predefined constructs. The range of emotions, thoughts, and memories must be limited to the boundaries set by the researcher. While measurement of nonempirical phenomena, given predefined constructs for instrumentation, can be repeatable, there are limitations based on the researchers' attempts to explain the variance of the constructs. Measurement requires translating phenomenon into a representation of reality and, therefore, the responses are bounded. For example, the Wong-Baker scale attempts to quantify a child's emotion and bounds the range of emotions into six choices (Figure 3-1). Thus, the instrument forces participants to select from the options available, even if the choices do not precisely fit. Likewise, the instrument provides researchers with a standard for gathering data on emotions and allows for the transference of the findings across multiple contexts.

In order to conduct research on phenomena that are difficult to measure, researchers must operate from a philosophical paradigm that is different from the hard sciences. "Qualitative researchers stress the socially constructed nature of reality, the intimate relationship between the researcher and what is studied, and the situational constraints that shape their inquiry" (Denzin & Lincoln, 2003).

Denzin and Lincoln warn social scientists about the risks of quantification and the development of instruments that show biases that are undisclosed in quantitative research. Ultimately, there must be a balance between developing instrumentation standards and purely

qualitative context bound research. Instrumentation and measurement allow social science to develop theories that can be tested and provides foundational research for future inquiry.

Qualitative research uses a variety of tools for data collection including focus groups, historical research, and interviews. There is a variety of traditions that a researcher can utilize to examine the data. According to Creswell, there are five traditions of qualitative inquiry: biography, phenomenology, grounded theory, ethnography, and case study (Creswell, 1998). A biography collects data in the form of literature reviews and interviews, and explores human life. Since the focus of inquiry for this research was the stakeholder's response to transgenic ornamentals, neither biography nor ethnography were a logical choice.

The remaining three methodologies, case studies, phenomenologies, and grounded theory research are used to examine phenomena and events. These methods would have been applicable to the GloFish™ study depending on the perspective desired. A case study would have to be bounded by the limits of an entity, such as a corporation, and required a variety of data collection tools to draw conclusions about the company or policy under investigation. A GloFish™ case study would also have been an effective research tradition, however the study would have only examined a time bounded instance, such as the first introduction of the GloFish™ to pet stores. Examining only the initial response of the stakeholders would not have provided an accurate model of their evolving sentiments, since many of the retailers began, then discontinued selling the fish. As well, theoretical sampling, an integral component of grounded theory research, required a diversity of participants to test the theory's boundaries. Likewise, a case study would have provided a rigorous examination of only the initial responses, which would have mimicked innovation adoption theories.

Qualitative Research Issues

Considerable debate has taken place between qualitative and quantitative research camps required measures of validity and reliability. The two camps address reliability and validity in fundamentally different ways based on differing perceptions of how truth is known. Thus, a philosophical difference exists underlying quantitative and qualitative research. Tangible phenomenon can be evaluated with instruments and with numeric representations of the event. Phenomenon that cannot be touched, felt, seen, heard, or smelled does not lend itself to a quantitative representation. For example, personality can be measured using an instrument such as Myers-Briggs inventory, but the instrument cannot fully encapsulate the broad range of emotions, thoughts, and actions that constitute personality.

Qualitative research is fundamentally different from quantitative methods in that the results are not generalizable and the researcher is an integral part of the data collection process. Another difference is that there is no single correct way to interpret the qualitative results (Janesick, 2000). Multiple interpretations can be made from the same data given variations in researcher biases and paradigms. In addition, the researcher accepts that validity and biases are intertwined with the results and can be revealed, but not removed. Both qualitative and quantitative researchers must identify, contend, and solve validity issues to enhance the quality of their research. While some qualitative researchers believe that they do not need to address validity issues, an effort must be made to enhance the quality and transferability of the study. Reliability, trustworthiness, quality, verification, and transferability are used to evaluate the results of a qualitative study.

Grounded Theory

The debate between the validity and importance of qualitative methods reached a head in the cold-war era when the emphasis was on the scientific method of discovery. Grounded theory

was developed by two sociologists, Glaser and Strauss, while exploring social interactions in hospitals, specifically death and dying (Glaser, 1965). They developed the methods to lend credibility to their research. Today, the majority of grounded theory research remains in the health sciences and it has become the qualitative toolset for examining elusive phenomenon in the medical field.

The ideology driving grounded theory was the development of a systematic process for developing theory from both quantitative and qualitative data (Walker & Myrick, 2006). Grounded theory is a postpositivistic structured iterative nonsequential process used to reveal theories (Figure 2-1). While qualitative research purists question the efficacy of placing postpositivistic conceptions of reality into a positivistic process for conducting research, the theories generated from the methodology have withstood the test of time (Denzin & Lincoln, 2003). The primary difference between grounded theory and other qualitative traditions is that the data reveal the theory in an iterative evolving process. There are no hypotheses formulated, rather, a statement of purpose directs data collection and preliminary coding.

Two types of theory can be generated using this process: formal theory and substantive theory. Formal theory explains broad concepts such as death, power, and war. Likewise, substantive theory is more specific and addresses specific social processes. The type of theory developed depends on the research question (Glaser & Strauss, 1967/1999).

A fundamental component of research is creating a sample to study. Sampling allows quantitative researchers to use inferential statistics to make generalizations to the larger population. Sampling can be broken into two categories: probability sampling and nonprobability sampling. Probability sampling attempts to randomly select participants to avoid the introduction of systematic error that could impact the validity of the findings. Likewise,

nonprobability sampling selects individuals based on previously defined criteria and therefore has a nonrandom component. Researchers favor probability sampling since non-probability sampling increases the risks that the variance measured by the dependent variable is spurious.

Qualitative researchers employ nonprobability sampling techniques, since hypotheses are not tested. For qualitative inquiry there is no effort to generalize the findings since the results are context specific. Qualitative researchers must explain how the sampling took place using thick description and the reasoning behind the selection of the participants must be made clear to the reader.

Grounded theory research, unlike most qualitative traditions, relies on a prescriptive non-random sampling technique that begins with “theoretical sampling” and ends in “discriminate sampling” (Corbin & Strauss, 1998). The progression begins by selecting participants with the most variance to test the boundaries of the theory and ends with selecting participants with the characteristics that populate the final categories.

A key component of building theory requires selecting a population that will reveal insights. Theoretical sampling requires the isolation of groups which have attributes that manifest emergent theory when compared. The challenge to the researcher is to maximize the opportunities to discover variations and inconsistencies among groups. Thus, the comparison groups are selected based on their theoretical relevance (Corbin & Strauss, 1998). While it is impossible to state what groups will arise from the research, there are boundaries that can be placed on the population. The boundaries must be ameliorated by the emergent theory, and then be moved to further verify the findings. The precursor to the theory is the development of categories. Glaser and Strauss created a rubric to explain the relationship between the amount of data collected on a category and the difference in groups. (Table 3-1).

Theoretical sampling continues until each category becomes saturated, when no other participant's contribution would not be explained by the developed theory (Glaser & Strauss, 1967/1999). Using the more structured formula, theoretical sampling consists of initial sampling, followed by open sampling, axial sampling, and categorical sampling. The sampling parallels the coding process and is an iterative process (Corbin & Strauss, 1998). Ultimately, theoretical sampling is sampling with a purpose, and it is an iterative and deductive process.

For the initial sampling, the researcher is interested only in collecting information to help begin building categories. When research begins, the drive will be to develop as many categories as possible. A questionnaire or interview protocol should be developed based on the literature and previous studies (Corbin & Strauss, 1998). After several interviews, the categories will begin to appear in most of the interviews. Following the analysis of each preliminary interview, the subsequent participant will be selected based on the previous results. The initial sampling rapidly creates categories and leads to open sampling.

During open sampling, the researcher's goal is to name, isolate, and categorize the phenomenon of study. To begin categorizing the persistent themes, the researcher must probe while sampling in a way to maintain openness to the emergent categories. The results from each interview are contrasted with the previous result. Open sampling seeks to verify the relevance of the categories developed from the initial sampling. In effect, it is the first instance when the data drives the selection of subsequent participants.

Once the categories have been developed, the next form of sampling, relational and variation sampling begins. Relational-variation sampling seeks participants that will maximize the range of variance. The results from the analysis are compared across sites or persons to uncover similarities and differences.

Finally, discriminate sampling takes place to select participants. The purpose of discriminate sampling is to sample for participants with the greatest differences. Unlike relational-variational sampling that samples to saturate categories by maximizing the range of variance among categories, discriminate sampling seeks to locate outliers. The final sampling step, discriminate sampling, should integrate categories along dimensions to form a theory. Discriminate sampling is the most selective and only selects individuals who will demonstrate the range of samples under which the theory applies.

Theoretical sampling begins with a larger sieve and ends with highly selective criteria. Probability sampling techniques would result in a limited exploration of the boundaries of the emergent categories. The process allowed for the development of emergent theory rather than biasing the theory by creating categories and seeking participants who fill the needed roles. As categories arise from the coding process, the boundaries of those categories must be tested. In order to establish what criterion makes a category relevant, a sample must be selected to test the theory. The coding process and sampling process work in unison to develop the theory.

The process is fundamentally different from the scientific method since there are neither hypotheses generated nor inferential statistics employed to generalize the findings to the population at large. Once the categories have been created by analyzing the interviews, they must be tested again. In addition to this iterative process, grounded theory requires the researcher to make meaning of the data. It is the researcher's role to determine the data that is relevant to the development of the theory.

Generalizability is not possible in qualitative research; however, the findings can be transferred to similar instances. To increase the transferability of the study, biases and environmental influences must be revealed. As well, building transferable theory requires

selecting a population that will reveal the diversity of responses to the phenomenon in question. Theoretical sampling requires the isolation of groups which have attributes that manifest emergent theory. Qualitative researchers refer to the quality and credibility rather than internal validity of the study. The quality of the research requires more effort on the part of the audience than quantitative research. The credibility of the study should be judged by the reader and based on how the researchers draw their conclusions from the data (Glaser & Strauss, 1967/1999).

There are, however, several threats to quality. First, theoretical sampling might not pull from the range of opinions and lead to an inaccurate theory. To avoid partially developed categories, selecting the correct participants is critical. Significant effort must be made to interview people with the desired attributes that will test the boundaries of the emergent theory. Secondly, people are heavily influenced by the researcher's presence, tone of voice, and affect. The researcher must be introspective, astute, and self-aware to be able to collect high quality data, and must allocate time to examining his influence in the narrative. Third, while Creswell estimates that approximately twenty interviews are needed to reach saturation, a sample size too small could leave categories neither sufficiently tested nor completely saturated (Creswell, 1998). The only criterion for sample size in a grounded theory research is that all categories have been fully explored. Fourth, the final product draws from questions during interviews that can be leading. The research can reduce the validity of their findings by not asking the correct questions.

Corbin and Strauss (1998) and Lincoln and Guba (1990) utilize the term validity to describe an evaluation attribute. According to Lincoln and Guba the trustworthiness, validity, of qualitative research can be judged by four criteria. First is isomorphism, the appearance of the phenomenon among two or more respondents (Lincoln & Guba). Secondly, the researchers must

state biases to avoid tainting the findings with their perceptions. There must be narrative that explicitly describes the researcher's background, biases and attributes that could influence both data collection and analysis. The narrative must include insight into the researcher's paradigm and mode of thinking and reveal the biases that impact the emergent theory. Third, validity also must have consistency across multiple instances. Finally, the results must be transferable and generalizable to other situations.

Corbin and Strauss (1998) recommend triangulation, negative case analysis, and testing for rival hypotheses to evaluate qualitative research. Triangulation either verifies the data with current literature and sources, or additional research can be done either quantitative or qualitative that will either uphold or reject the findings. Denzin (1978) suggests the research employs four types of triangulation: (a) data triangulation, (b) investigator triangulation, (c) theory triangulation, and (d) methodological triangulation. Data triangulation compares data across multiple studies. Investigator triangulation compares the finding among several different researchers. Theory triangulation takes place in the form of a literature review to verify that the theory holds up across multiple disciplines and supports the current theoretical framework. Finally, methodological triangulation verifies that the methods used to reach the conclusions have been proven and employed in answering similar research questions.

Present Theories

Like genetically modified ornamental fish, other innovations, such as woolen mills, coffee, televisions, nuclear power, automotive manufacturing robots, and microwaves all resulted in public outcry (Pendergrast, 1999; Randall, 1986). The Atomic Energy Commission underestimated the public backlash to atomic energy (Juma & Calo, 2002) Historically people oppose change. To be successful then, innovators must introduce new technology carefully to avoid backlash (Phillips & Corkindale 2002). The agricultural biotechnology industry failed to

address the public's concerns when they began employing genetic engineering to create new cultivars for the world food supply (Harries-Rees, 2003; Juma & Calo, 2002; Wolt & Peterson, 2000). Genetic engineers assumed that education through information would lead to the formulation of positive attitudes toward their products. Because they failed to communicate effectively with the public, they created an uphill battle in gaining the public's trust (Phillips & Corkindale 2002).

Beyond simple press releases and public relations efforts, there are social and psychological forces that determine consumer responses to new technologies. Since mass media serves an integral role in educating and disseminating information about new technologies to the public, communication strategies have a heavy impact on consumer sentiments (Shanahan, Scheufele, & Lee, 2001). Researchers have deconstructed the growing opposition to genetic engineering using a number of paradigms and theories. While each theory points to the perception of risk as the driving force of the resistance, they differ in exploring how communications created the perception.

First and second generation biotechnologies were all plants with attributes benefiting the producer such as Round-Up Ready™ Soybeans and Bt Corn and Cotton (Stewart & McLean, 2004). Third generation biotechnologies will begin to provide the public with valuable attributes and will include both plants and animals (Guynup, 2000; Lewis, 2001). Communication theory specific to addressing ornamental retailers' responses to transgenic ornamental fish has not been developed, however, Sociocultural, Cognitive Science, and Reasoned Action theories all partially explain why retailers have responded negatively to the introduction of the GloFish™.

Theoretical knowledge on transgenic fish divides by either academic traditions or business sectors. While little research has specifically addressed the GloFish™, extensive research on

public response to the broader biotechnology and aquaculture sectors has been carried out (Lewis, 2001; Phillips & Corkindale, 2002; Titchener & Sapp, 2002). Most of the information available comes from mass media sources rather than academic journals. From an academic perspective, the schools of psychology, business, political science, biology, public relations, agriculture, journalism and mass communications have examined issues in biotechnology from the standpoint of various paradigms. From a business sector perspective, research has been conducted in the aquaculture, biotechnology, agricultural biotechnology, and the pet industries.

The largest body of literature examining the transgenic zebra danio exists in the scientific community. Thus, the overwhelming majority of the research has been experimental and highly positivistic in nature. Molecular biologists and geneticists began using the fish for research due to its survivability and fecundity in the 1990's. In 1997, the National Institute of Health (NIH) recognized the importance of the zebra danio in understanding human disease and created the Trans-NIH Zebrafish Coordinating Committee to spearhead and organize international research (Henken, 1998). The Sanger Institute began sequencing the genome for *Danio rerio* in 2001 and is currently more than 60% complete. The Zebrafish Information Network (Zfin) lists over 6500 publications pertaining to the fish.

A large body of research describes bioreactor constructs, fluorescent proteins, and other potential uses for the fish in biomedical and oncological research (Cheng, Christie, & Valdimarsson, 2003). Dr. Gong at the University of Singapore is the foremost researcher in adding fluorescent protein genes to zebra fish genomes. In 1999, Ju and his colleagues (1999) published an article describing the expression of green fluorescent protein in the musculature of the fish; this was the predecessor to the red fluorescent species, the GloFish™ (Ju et al., 1999). The publication defined the methodology for inserting fluorescent protein genes used as genetic

markers into the mlyz-2 promoter region, and future research was done to improve the genes' expression (Ju et al., 2003). Other species and strains have now been developed, including a two color zebra fish, but no others have been commercialized.

In contrast to the scholarly journals on developmental genetics, molecular biology, and biochemistry are the applied aquaculture research journals. This research is generally applied in nature and pertains to food fish rather than ornamentals, particularly the major food fish species, such as shrimp, salmon, tilapia, and clams, that represent the bulk of the industry's financial impact on the fisheries industry. Extensive studies on transgenic salmon and the public perception of transgenic food fish have been conducted as well as studies analyzing the environmental impact of the introduction of genetically modified fish into the ecosystem (Carr, Anderson, Whoriskey, & Dilworth, 1997; Hedrick, 2001; Institute for Social, Economic, and Environmental Sustainability, 2003; Kapuscinski & Hallerman, 1991; McGinnity et al., 1997; Muir & Howard, 1999; Pew Initiative, 2004). As well, aquarium hobbyists preferences for certain fish have been deconstructed in survey research (Alencatro, 2004).

Literature indicating possible environmental degradation delayed the Food and Drug Administration's approval of transgenic salmon. Muir and Howard's Trojan Gene Hypothesis, which predicts the collapse of native fish stocks due to the introduction of an escaped transgenic salmon, has been cited by special interest groups as a potential result of commercializing the GloFish (Center for Food Safety, 2004). Transgenic ornamental fish inherit the environmental concerns generated not only from the aquaculture sector, but also from the transgenic food industry.

Survey research is the most common methodology for examining public response to agricultural biotechnology. A Google™ search revealed 366,000 hits on "GMO Surveys." No

results appeared when “GloFish™ Survey” was entered. A considerable amount of qualitative work has been done examining the public’s reaction to the broader biotechnology sector, but no research specifically addressing transgenic ornamental fish has been reported (Pardo, Midden, & Miller, 2002; Phillips & Corkindale, 2002; Pew Initiative, 2003).

Articles from special interest groups such as Greenpeace and the Center for Food Safety appear in online searches of the web, but these lack rigorous methodology, and are based on parallel studies by Muir and Howard (Center for Food Safety, 2004; Greenpeace International, 2004; Muir & Howard, 1999).

The five most applicable theoretical ties used to explain the public reaction to third generation biotechnologies are Sociocultural theories, Social-Cognitive theories, Reasoned Action theories, Decision-making theories, and Diffusion of Innovation theories. Sociocultural theories contend that the growing negative sentiments towards biotechnology stem from societal risk perceptions. The theories are applicable when investigating the impact of invasive species such as the snake-headed fish on the public’s conscious. Social cognitive theories explain how the public builds sentiments and beliefs through both cognition as well as societal influences and is highly applicable given the negative publicity surrounding aquaculture and genetically modified foods (Bandura, 2002).

The impact of special interest groups can be examined using Social Cognitive as well as Sociocultural paradigms. Schools of psychology have examined agricultural biotechnology by studying risk perception in humans and applying social and cognitive theoretical paradigms (Stewart & McLean, 2004). Reasoned action models have been used to predict consumer reactions to genetically modified foods (Wolt & Peterson, 2000). Decision-making theories are relevant to the investigation since the decision to buy or not buy transgenic ornamental fish is at

the heart of the research. The process that potential buyers use to reach a buying decision must be investigated. Finally, Roger's Diffusion of Innovation theory explains why some retailers are earlier adopters of the technology, while others shy away from playing a maverick role in their industry.

Sociocultural and Cognitive Science Theories

Socioculturalists and cognitive scientists examine how people form attitudes and develop knowledge. The sociocultural camp contends that public attitudes result from discourse in the risk assessment of the new technologies and the development of public attitude is multifaceted (Helene, 2003). The discourse includes weighting tangible hazards against the benefits the consumer receives from the risk, and cultural, political and normative influences (Helene, 2003; Titchener & Sapp, 2002). The cognitive science perspective examines how knowledge and objectively defined risks influences people's behaviors. They theorize that people form attitudes based on a rational model derived from the available information (Titchener & Sapp). Cognitive scientists support the notion that knowledge itself can promote the acceptance of technologies, while socioculturalists examine the holistic societal process of attitude formulation (Titchener & Sapp).

Bandura's (2002) Social Cognitive Theory uses the model of "triadic reciprocal causation" and assumes people learn from a variety of sources. Bandura investigated the influence of mass media on the development of attitudes and opinions and is attributed to linking violence in children with violence on television (Bandura, Ross, & Ross, 1961). In this theory of psychological function, the environment, perceptions, and behavioral act bidirectionally and allow people to exert control over their environments (Bandura, 2002). The perceived ability of the individual to control his environment heavily influences behavior. "Cognitive processes"

assemble the information available to the individual to determine the desirability of the behavior (Bandura, 1994).

The Social Cognitive Theory also addresses how mass media constructs knowledge. Bandura contends that television portrayals influence viewer beliefs. Other mass media outlets, while not as rich as television, also contribute to the development of beliefs and attitudes. In addition, the action of others can lead to the reinforcement of these beliefs and potential actions. Bandura viewed behavior causality as the result of numerous and exhaustive “determinants” (Bandura, 2002).

Thus, the negative publicity surrounding GM crops in the media, and the efforts of special interest groups compounded to build negative frames around genetically engineered products. Because negative media coverage of agricultural biotechnology has increased since 1997, the resulting public backlash can be explained by Social Cognitive Theory (Shanahan, Scheufele, & Lee, 2001). The Starlink™ scare, and other food supply crises, such as Mad Cow, have had a deleterious impact on the public’s perception of new technologies (Uchtmann, 2002). As well, efforts by special interest groups such as Greenpeace act to create knowledge that impacts future behaviors. The Atlantic Institute of Market Studies (2004), while examining only aquaculture, indicated that special interest groups rapidly tainted public opinion regarding the environmental friendliness of salmon aquaculture. Due to the climate created by anti-GMO groups, Gerber foods announced it would not use GM products in their foods, and no large retailers would stock transgenic ornamental fish (Titchner & Sapp, 2002). The knowledge people accumulate serves as their risk barometer for the unknown. Therefore, if people do not fully understand the science behind genetically modified foods, they will leverage information accumulated from previous media sources to determine the risk of consuming the products.

Traditional marketing efforts for GM foods have used models rooted in Cognitive Science paradigms. Sharpe, however, has demonstrated that knowledge alone does not predict the publics' positive or negative beliefs pertaining to biotechnology (Sharpe, 2002). Efforts to reduce smoking and drunk driving have followed this model with limited success and exemplify the limitations of using a rational model to change behaviors. Yet, when efforts were made to increase the efficacy of public announcements against drunk driving, people were more likely to internalize the information (Anderson, 1995). Phillips and Corkindale noted that "education is a weak force at best," but the agricultural biotechnology sector has relied on this paradigm to address consumers' negative responses to GM foods (Phillips & Corkindale 2002). Draper and Green (2002) performed historical research to analyze the evolution of the role of the public in food policy. They discovered that consumers' risk perceptions transcended a strictly rational model.

In short, rather than being an "ignorant" and passive object of food policy, the "sociological" subject is a rational individual who is a consumer (in that he/she makes individual choices), but whose choices are framed by his/her cultural, social, and material circumstances. (Draper & Green, 2002)

Uses and Gratifications Theory explains the shortcomings of using a cognitive model to communicate biotechnology concepts to a lay audience. The theory attempts to explain why people choose certain types of music, internet sites, and newspapers, but also demonstrates how people build knowledge using different types of media (Blumler & Katz, 1974). Since media will lead to the development of knowledge in a specific genre, according to Bandura, the gratification people receive from consuming certain types of media determines the development of attitudes and beliefs (Bandura, 1994; Ruggiero, 2000). Therefore, media that does not provide gratification will not lead to the formulation of attitudes and beliefs.

Educating the public about complex scientific issues is challenging since it requires an interested learner to seek information. From a Uses and Gratification perspective, general agricultural biotechnology self-education will be rare since there is no immediate gratification beyond self-affirmation in using the media sources. To understand the risk and benefits of supporting the technology, a knowledge search is necessary to build a precise and accurate risk valuation matrix (Wolt & Peterson, 2000). People do not get gratification, however, from reading public relations materials printed by probiotechnology entities. Thus, the Cognitive Science model of communication is a poor choice for building public support. Ironically, the lack of gratification from consuming biotechnology media is an advantage to GloFish™ proponents since people will not seek out information that would make them unwilling to buy the fish.

Titchener and Sapp (2002) performed a survey of 10,000 households to determine if opinions toward biotechnology were influenced more heavily from the Cognitive Science or Sociocultural perspectives. The researchers discovered that a person's risk assessment transcends the viewpoint of cognitive scientists and includes societal influences. "Individuals, rather than experts, ultimately will decide whether to adopt or reject new technology" (Titchner & Sapp). Additionally, a large proportion of the individual's decision is influenced by norms, attitudes, beliefs, and values. While previous survey results indicated that education and information are not predictors of biotechnology acceptance, they are the basis upon which buying decisions are made (Priest, 2000). "Social influences must then be incorporated within the theoretical approaches to best understand the potential adoption or rejection of complex and controversial new technologies" (Titchner & Sapp, 2002). These findings reaffirm the concept

that norms and social pressures play a heightened role in the development of attitudes when the understanding of the technology is reduced.

Theory of Reasoned Action

The Fishbein-Ajzen (1975) theory of reasoned action explained not only the development of negative attitudes toward biotechnology, but also peoples' behaviors toward genetically modified products (Figure 3-2). The public's buying decisions with regard to GloFish™ should have followed the Fishbein-Ajzen theory of Reasoned Action, therefore, people should have made "systematic use of information available to them" and will use the information as the basis for the formulation of attitudes (Ajzen, 1991). The theory contended that a large percentage of human action is predictable if attitudes, norms, beliefs, sociological influences and intentions were known (Fishbein & Ajzen). The model is highly rational in nature and has been criticized for its over simplification of human behavior, however, the model potentially could explain some of the variance involved in the public's reaction towards biotechnology.

Fishbein and Ajzen (1975) created expectancy value models to predict human behaviors based on norms, locus of control, and attitudes. The Theory of Planned Behavior examines eight aspects of human behavior in three categories: beliefs, behaviors, and intentions.

The first grouping addresses the individual's beliefs and attitudes. Beliefs lead to attitudes and norms which then drive the intention and subsequent behavior. Behavioral beliefs are what an individual believes will happen as the result of their actions. The attitude toward the behavior is the positive or negative valuation of the performed behavior. Next, societal consequences and beliefs are defined. Normative beliefs are societal norms and values, while subjective norms are the perceived social consequences and pressures of performing a behavior. Fishbein and Ajzen (1975) were influenced by Bandura and his concept of Locus of Control (Bandura, 1994). The

control beliefs are the ideas that exist regarding what could interfere with the action, and the perceived behavioral control is the perceived ability of the individual to influence the factors.

Researchers have already linked the public's negative reaction against GM crops to their perceived consequences of consuming GM products (Castro, 2006; Joffe & Lee, 2004). The power of special interest groups rests in their ability to alter the perceived consequences of performing actions and generating attitudes and beliefs that question the safety of new transgenic products. Poor transparency of the regulatory agencies, past failures, and a general lack of trust in large multinational businesses add to the cognitive uncertainty of the safety of such biotechnologies as the GloFish™. The Reasoned Action Theory demonstrates how the efforts of special interest groups have significant deleterious consequences for the industry by falsely elevating the perceived consequence of consuming genetically modified products. The strategy of special interest groups has been to place doubt in people's minds about the safety of the technology, and, ultimately, to change buying behaviors.

Intention is the "immediate antecedent or behavior" and represents a person's readiness to perform a behavior (Ajzen, 1991, 2005). "The intention is based on attitudes toward the behavior, subjective norm, perceived behavioral control, with each predictor weighted for its importance in relation to the behavior and population of interest" (Ajzen, 2005). Finally, the actual behavioral control refers to the availability of the resources required to perform the resulting path of best fit behavior.

Behavior represents the final product of the cognitive process. All six categories of beliefs, norms, and attitudes interact to lead to the behavior. For example, the attitudes of the behavior are influenced by both society and previously held beliefs. If one area is less developed than the other, then increased emphasis will be placed on the more established source of knowledge.

According to the Reasoned Action model, behavior results from weighing societal norms, attitudes, and personal belief that the behavior can be performed with the perceived consequence of a behavior. Thus, changing any part of the cognitive decision process results in a change in the potential behavior.

Therefore, the reaction to reject the GloFish™ results from a rational assessment of the risks, benefits, and perceived control over the situation. Since rejecting the GloFish™ is the manifestation of a cognitive process pooling data from information sources, normative beliefs, and perceived risks, changing the behavior requires a multifaceted approach. If the cognitive process utilizes the media sources containing anti-GMO information, then the resulting behavior would reflect the valuation of that information source.

The consequences of purchasing a GloFish™ are not tangible to the consumer, but for larger retailers the consequences of stocking the fish could result in loss of business in other departments. The larger retailers, however, are basing the risk on perceived consequences rather than actual consumer response. In effect, the Reasoned Action model explains the reluctance of those large retailers who stock other items besides aquarium paraphernalia to perceive the risk to other aspects of their business too great to justify the profits made from stocking ornamental transgenic fish.

Decision-Making Theories

Decision-making research falls into either the descriptive camp or the prescriptive camp. Descriptive researchers try to understand how decisions are made while prescriptive researchers attempt to improve the decisions. The area of research that is applicable to this study is the descriptive branch, which describes how decisions are made. The decision to stock or not stock the GloFish™ constitutes the essence of this research. Generally people are poor decision makers and fail to allocate the resources required to reach a quality decision. According to

Simon and March, people have “bounded rationality” and fail to accumulate the information needed to make high quality decisions (Simon & March, 1958). The small effort dedicated to the task stems from incorrect assumptions about the positive and negative outcomes, and potential risks associated with a course of action. The reduction in resources used to make decisions relates to their scarcity. Simon and March described the concept of “satisficing” versus “optimizing.” “Satisficing” describes the minimal amount of work the decision maker will undertake to acquire the information to make decision, likewise “optimizing” describes the ideal due-diligence that should go into the decision making process. The two ends of the “satisficing-optimizing” continuum explain the increases in efficiency but decreases in quality of decision-making (Simon & March).

Huber defines decision-making as, “The process through which a course of action is taken” (Huber, 1981). Decision-making deals with problem definition and diagnosis and the seeking of alternative solutions. Decision-making collects the information that feeds into the choice-making process.

Finally, the broadest of the terms is problem solving which includes both choice-making and decision-making as well as the implementation of the choice. Huber (1981) leverages Simon and March’s (1958) concept that humans have limited intellect and limited information availability when they make decisions and must use tools to expand their capabilities. Humans must “satisfice” and select the more efficient process since “optimizing” requires “several orders of magnitude” more effort. As a result of the limits to human rationality, managers use inadequate models to make decisions and employ overly simplistic decision strategies.

Information represents the input into the problem solving process. Since the raw material for management and the problem solving process is information, Huber identifies several types

of information and the sources and uses of each. His identification of the information types enriches Simon and March's concept and helps management optimize the decision-making process. Huber categorizes information as "basic information," "elaborating information" or "performance information" (Huber, 1981).

Retailers must decide to stock or not to stock transgenic ornamental fish using the information available to them combined with previous beliefs about the safety and economic viability of the product. The GloFish™ is not consumed and has attributes that the consumer desires. From a uses and gratification perspective, the risk in consuming genetically engineered food is tangible and high, while purchasing a GloFish™ presents few perceived risks to the consumer.

As Simon and March (1958) stated, the decision-making surrounding the decision to stock the fish is based on bounded rationality. People not only want to minimize the time spent researching facts but also want to categorize biotechnology using previously developed schema. One of the biggest mistakes and weaknesses of the pro biotech audience is that they try and use rational approaches to justify the safety and lack of risk in genetically modified products. This is an advantage to GloFish™ proponents since people will not seek out information that would make them unwilling to buy the fish. Understanding transgenic technology is not salient to the basic aquarist's decision to purchase a GloFish™; the aquarist does not link the colorful fish to transgenic technology. Consumers don't care enough about the controversy since special interest groups are unable to create uncertainty and sensationalism around a one-inch ornamental tropical fish. Independently, they do not provide an adequate explanation for why certain retailers have refused to carry the product.

Diffusion of Innovation Theories

Diffusion theories attempt to explain how new innovations spread through social entities. While rooted in sociology, diffusion theories explain paradoxes such as the rejection of keyboards capable of speeding the pace of typing, atomic energy, and genetically modified crops (Bauer, 1995/1997a; Juma & Calo, 2002; Rucht, 1995/1997). The theories examine social forces influencing the rate, extent, and processes of how changes (innovations) are incorporated. The development of transgenic stocks of ornamental fish represents a significant innovation for the aquarium industry. For the retailer, new exotic species can be marketed to tropical fish enthusiasts. As well, aquaculturists raising ornamental fish no longer can breed fish without paying royalties to patent holders. The ramifications of selling the GloFish™ go beyond ornamental fish to include the use of genetic engineering to create pets with desirable attributes.

Gabriel Tarde, a French sociologist, pioneered diffusion research. He discovered that new technologies were adopted according to an S-shaped curve (Figure 3-3). Some new technologies had steep S curves while others had flatter S curves indicating a slower adoption speed. Thus, there is a lag at the beginning of the adoption cycle following a rapid rate of acceptance. At the end of the cycle, the remaining skeptics slowly incorporate the innovation. Tarde's S curve has been proven to be a viable model explaining the adoption rate of most new technologies (Rogers, 1962/2003).

A study performed at the University of Iowa in the 1940's by two Sociologists, Bryce Ryan and Neal Gross (1943), has a special significance for understanding the adoption of biotechnologies. Ryan and Gross examined the adoption of hybrid seeds by farmers. They found that hybrid seed use diffused rapidly from 1936 to 1939, but few farmers used the seeds exclusively for the first year. Most importantly, the researchers discovered that a neighbor's decision to plant the hybrid seed was the largest determinant for adoption. While salesmen

provided information to farmers, it was the interaction and knowledge exchange between colleagues and neighbors that determined if the farmers accepted the hybrid seed (Ryan & Gross, 1943).

The most influential diffusion of information researcher of the 20th century is Everett Rogers (2003). In his book, *Diffusion of Innovation*, he describes the process of diffusion, its components, and the type of people most likely to adopt technologies first. Rogers's model of diffusion of innovation includes four components: the innovation, communication channels, time, and the social system. The innovation is the technology or change. Communication channels refer to the information exchange about the technology. Time has three components: the decision to adopt the technology, the pace of the individual's adoption, and the time elapsed from the introduction to implementation of the technology. Lastly, the social system refers to the bounded social unit to receive the new technology. Rogers coined the terms "innovator, early adopter, early majority, late majority, and laggards" to describe the time of technology adoption. Rogers defined Ryan and Gross's "neighbor" as an "opinion leader," someone a potential adopter views as more informed than they themselves are.

Rogers (1962/2003) outlines five stages of adoption: awareness, interest, evaluation, trial, and adoption. The awareness stage is marked by first learning that a new technology is available. After the awareness stage, the potential adopter may gain an interest in learning more about the innovation. During the interest stage the individual seeks information that will lead to an evaluation of the risks and benefits assessment of adopting the technology. Following the assessment, the adopter will trial the new technology and will either accept or reject it. If the individual does not reject the technology, they will then move to the final stage, adoption (Rogers).

Diffusion of innovation research fails to explain the adoption of genetically modified fish by aquarium retailers. While the adoption of the technology follows an S-curve regarding the number of adopters over time, the process of adoption does not follow the Rogerian model. As well, the largest retailers do not sell GloFish™. Despite opinion leaders' stamp of approval and the interest in the tropical fish industry to differentiate from large retailers, some stores refuse to stock the fish. Rogers (1962/2003) does not examine the morality issues in adopting new technologies, which do not lend themselves to a risk benefits analysis. While confidence in social intuitions' abilities to govern the new technologies has had a significant impact on adoption rates, there are other factors that are influencing the rate of the GloFish™ adoption that must be examined (Sapp & Korsching, 2004).

Conclusions

The biotechnology industry made false assumptions about the public's ability to evaluate the safety and desirability of products derived from biotechnology (Harries-Rees, 2003). The rejection of many retailer chains to stocking the GloFish™ exemplifies the result of a poor communication strategy. Communication efforts by special interest groups opposing the GloFish™ utilized tactics from the anti-GMO agriculture debate, but failed to gain support in the anti-GMO ornamental fish movement. Likewise, probiotechnology groups relied on a cognitive approach to communicating information to the public that also had shortcomings in convincing large retailers to stock ornamental transgenics. Unlike other first generation biotechnologies, the GloFish™ has attributes consumers find desirable, and it is purchased based on its physical attributes rather than perceived risk.

Ultimately, there are more factors involved in a decision to stock a GloFish™ than can be captured in previous research. Cognitive science theory fails to explain why people would reject the GloFish™ since it assumes that people think independently of societal norms. The

GloFish™, however, has desirable attributes. Therefore, from a Cognitive Science paradigm, the fish should be well received by the public when combined with public trust in the regulatory agencies.

Using a sociocultural lens does not provide a holistic representation of public reaction toward transgenic ornamental fish. The Mad Cow outbreak primed the public for skepticism about genetically modified foods, but does not influence consumers' buying decisions of genetically modified ornamental fish (Uchtmann, 2002). Socioculturalists overlook, as well, the value of purchasing a dangerous product; many aquarists possess an antisocial characteristic that drives them to buy potentially dangerous, venomous, and violent fish. Already nonindigenous populations of poisonous Dragon fish have been reported in many locations in the western Atlantic (Hare & Whitfield, 2003). The demand for piranhas and sharks most likely stems from their dangerous image rather than beauty attributes. Thus, the efforts of special interest groups working to create public fear towards GloFish™ could result in increased demand for the fish. While the sociocultural model explains the efficacy of anti-GMO groups toward transgenic foods, it fails to explain why retailers who stock fish that are known environmental threats will not stock the GloFish.™

The Fishbein-Ajzen (1975) model of Reasoned Action presents a compelling explanation for the public's reaction, but there are more factors at play than attitudes, beliefs, and actions. The model explains the variation in the responses of the large retailers, small stores, and consumers, based on perceived consequences. Since the GloFish™ has an attribute consumers value, enhanced coloration, and is tiny, appears benign, and is used as a decorative object rather than food, the perceived risk for consumers is low. Given the rational evaluation of the risks and benefits, the Reasoned Action model would predict overwhelming consumer acceptance of the

new fish. Nonetheless, some store owners are leery about consumer responses (Alan Blake, personal communication, February 12, 2004). While the response has been positive, an overwhelming acceptance has not been observed. Once the FDA approved the GloFish™ for capitalization, California immediately banned selling the fish, but later recanted the decision (Associated Press, 2003; Mastrup, 2003).

Finally, the decision-making process used by retailers to stock the fish does not follow a rational model. Retailers do not adhere to a rational Huberian decision-making process. However, Simon and March's (1958) theories appear to be valid since the retailers make the best use of the information available to them and "satisfice" rather than "optimize" their information collection.

Despite the failings of the broader agricultural biotechnology sector in introducing a new technology to the public, the GloFish™ is selling, and more genetically modified ornamental fish are in the pipeline. Researchers examined the public response to agricultural biotechnology using cognitive processing, societal influences, self-efficacy, and behavioral models, but a holistic model should be developed that explains the GloFish™ phenomenon.

Table 3-1. Differences in comparison groups

Amount of data collected on category		
Difference in groups	Similar	Diverse
Minimized	Maximum similarity in data leads to: (1) Verifying usefulness of category; (2) Generating basic properties; (3) Establishing set of conditions for a degree of category. Prediction (Quadrant 1)	Spotting fundamental differences under which category and hypotheses vary. (<i>Quadrant 2</i>)
Maximized	Spotting fundamental similarities with the widest scope of analysis. (<i>Quadrant 4</i>)	Maximum diversity in data leads to: (1) Dense developing of property of categories; (2) Integrating of categories and properties; (3) Delimiting the scope of the theory developed. (<i>Quadrant 3</i>)

(Glaser & Strauss, 1967/1999)

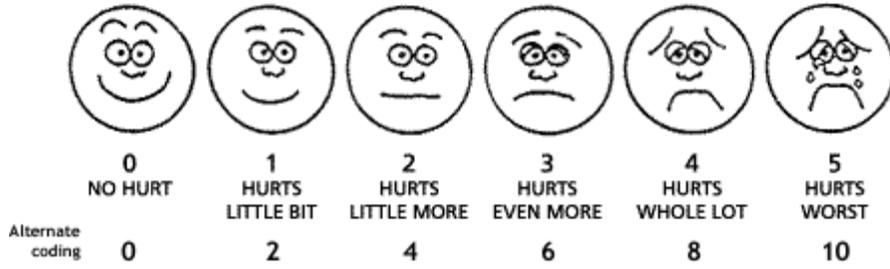


Figure 3-1. The Wong Baker Scale (Wong & Baker, 1988)

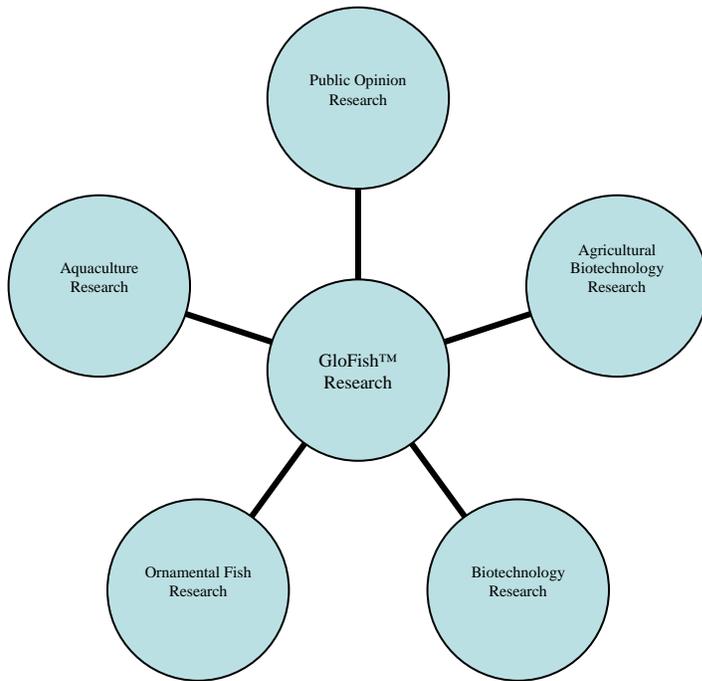


Figure 3-2. Areas of research for aquatic biotechnology

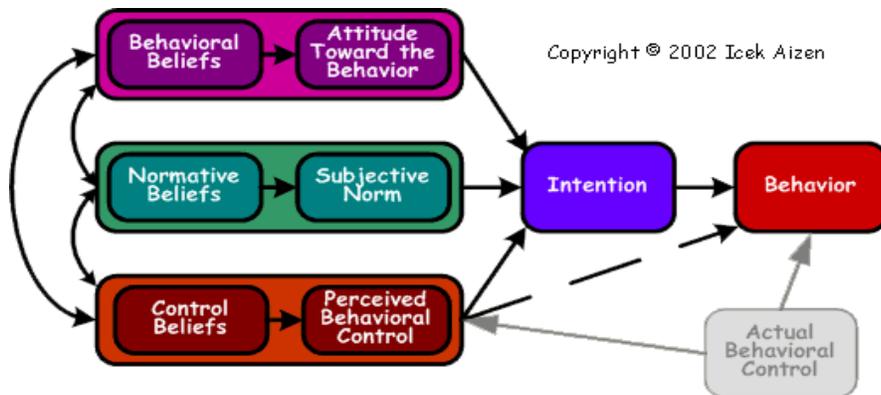
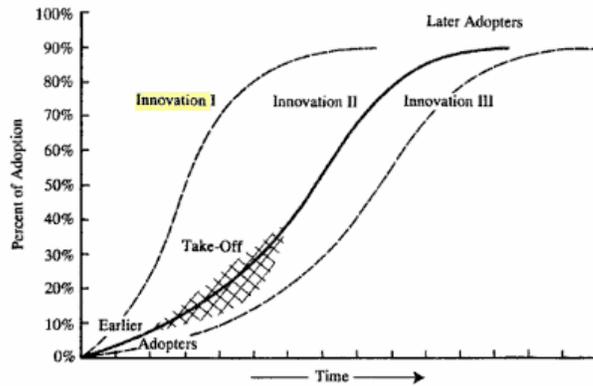


Figure 3-3. The theory of planned behavior (Ajzen, 1991)

Figure 1-2. The Diffusion Process



Diffusion is the process by which (1) an *innovation* (2) is *communicated* through certain *channels* (3) over *time* (4) among the members of a *social system*.

Figure 3-4. S-Curve: The diffusion process (Rogers, 1962/2003).

CHAPTER 4 RESULTS

The data collected could be interpreted a number of ways and should not be generalized to other sample groups. The results would be difficult to duplicate since creating settings in time and place to match the interviews would be nearly impossible. In addition, the observations and transcriptions from interviews were analyzed and interpreted by the researcher, which contributed to the fallibility to the study. The interpretation is rooted in the investigator and includes biases. Twelve 45-minute interviews were conducted for a total of 152 single spaced pages of transcribed data. The constant comparative method was used to investigate the variances among and between the participants.

Interviews were conducted over an 18-month period, and some variance in the responses from the beginning to the end can be attributed to the long duration of the research. Initially, heavy media coverage of the GloFish™ helped boost sales and bring new customers into participating retailers' stores. By interview 10, the hype had dissipated, and the last retailers' to participate did not perceive transgenic fish as the wave of the future. Therefore, the long duration helped ensure that the proper categories were developed to explain the retailers' reaction.

From the initial list of 80 participants, 12 were used to build the model. The differences among the participants were significant, and the total ranges of responses to the interview questions were collected. Participants differed in the type of products offered, geographic location, store size, education level, age, gender, religion, and previous attitudes toward genetic engineering. All aquarium retailers in Gainesville, Tampa, Orlando and Jacksonville willing to participate were exhausted. An effort was made to contact large retailers, but they were unwilling to participate in the interview process. Several off the record conversations, however, were

conducted with the largest pet retailers. One-hundred fifty-three unique codes were summarized into four families: ethics, economics, Jurassic Park phenomenon, consumer attributes, and regulation.

Grounded theory (Figure 4-1) required the investigator to complete each interview, code the transcribed results, and employ the constant comparative method to analyze patterns from all previous interviews. Therefore, there was variance from interview to interview with the categories, codes, and themes that manifested. As well, a semi-structured interview was employed that allowed for more flexibility to investigate the boundaries of the emergent theory. From interview to interview, the themes and families were variable until a formalized set of categories emerged after interview 8.

Interview 1 (Pilot): The Early Adopter

Overview

The first interview was conducted with the owner of an aquarium store in a small side section of the store among empty aquariums and boxes in Gainesville, FL that sold both marine and tropic fish. The staff exhibited a strong eagerness to help, and before the interview began, preliminary discussions revealed other researchers had inquired about the GloFish™. Unfortunately, initial dialog was not captured with a recording device.

Before conducting the formal interview, the informed consent form was signed, and several aspects of the research were divulged. First, the research was pro-GloFish™ and intended to help the ornamental industry. Second, it was explained that he was the first person interviewed to test the interview protocol. Finally, it was explained that the technology was safe, and sustainable, and that retailers who sell the GloFish™ should be supported. This initial exchange changed the course of the subsequent interview. Once the form was signed,

transcription began. The duration of the interview lasted approximately 25 minutes and was truncated because the owner had urgent business he could not ignore.

Location

In the course of the interview, the owner mentioned that Gainesville provided a unique market due to the presence of the University of Florida and a liberal population with “one foot in the PETA door.” Proximity to Tampa, the location of Seagrist and 5-D, the largest ornamental fish wholesalers in the United States, allowed him to become one of the early adopters. He believed that his location in Gainesville gave him a vantage to evaluate new products that other retailers do not have. His belief that Gainesville was a bell-weather market manifested in his statement that when the president of a large tropical fish farm has “some questions in terms of marketing,” he brings him in because “A, we’re here in Gainesville, and B, he knows he is going to get the truth.” Clearly his location in Gainesville contributed to his decision to stock the GloFish™.

Emergent Themes

Innovation. In the opening paragraph, the owner acknowledged that, “I wanted to be the first one to have ‘em, I knew they were coming for about 6 months.” The pressure for small ornamental fish retailers to carry innovative and unique products is great. Over the last decade, market growth in the ornamental fish industry has stagnated. The industry attributed the stagnation to the plethora of 21st century hobbies such as the internet and video games. He believed the industry must innovate to compete in this environment, and he contended that genetic engineering is the innovation needed to rekindle consumer interest. He clearly stated that his desire to continue to stock innovative products influenced his decision to be the first retailer in Gainesville to sell GloFish™.

Ethics. Implicitly, the owner admitted that the new technology was more ethical than previous methods used for making fish more colorful. He appeared to be wallowing in an ethical quagmire created by consumer demand for painted glass fish, a fish manually injected with dye. In explaining consumer response to painted fish, he admitted that he should probably not carry the fish, but also indicated that one reason customers come to him is to purchase fish that are not available anywhere else. He referred to GloFish™ as an “alternative” to the painted fish and indicates that his staff is eager to sell GloFish™.

Information. The availability of information was the most common theme in the interview, including not only the lack of positive information supporting the sale of the GloFish™, but also the lack of negative propaganda from special interest groups. Developers of the transgenic salmon spent 5 years awaiting a ruling from the FDA, while GloFish™ became the first transgenic animal approved for production in a span of a few months. The rapid approval allowed advocates of the new fish to reach consumers before special interest groups.

The participant wanted to provide full disclosure to the customer, and hoped that, given the information available, they would make the best choice. He believed the greatest impetus for customer acceptance of transgenic ornamentals was the availability of information. He noted that the first generation GloFish™ had a weak market response due, not only to minimal coloration, but also to lack of information for the consumer.

Hype. The owner stated twice that, “The first generation is not outstanding in terms of color.” As well, he admits that the price, combined with the lack of extreme coloration in the first generation, did not make the GloFish™ that economically important to his store. He admitted, however, that an interview on a local television station, which he deemed negative, nonetheless, had done a great job of creating interest among hobbyists. He stated, “I want them to talk a lot.”

Thus, one of the reasons for vending the fish was to stir controversy in a hobby that had become stagnant.

For an industry that has not grown rapidly in the last decade, the approval of the first transgenic animal for production has sent new aquarists to the pet store. He realized as well that the hype and stir are too much for the large retail stores, a decision that he admitted, “breaks his heart.” The niche for controversial products allowed him to differentiate his inventory that would otherwise be competing against large retail chains.

Economics. The participant stated that the GloFish™ had not been an economic boon for his store, but admitted that the hype was a boost. He noted that one reason other retailers were reluctant to be early adopters was the cost. He elaborated, stating that the primary reason retailers decided not to purchase transgenic stock was due not to the controversial nature of the product, but the price. The GloFish was far more expensive than the natural version and not clearly differentiated from its cheaper counterpart.

Safety. The pilot participant was asked to describe the protocol he used to determine if the GloFish™ was a product he wanted to stock. The process he described proved to be more emotional than rational. He reasoned that the fish was safe since the gene would be naturally selected out of the population through predation. Further, once he understood that fish that consumed the GloFish™ would not experience any genetic mutations, he was comfortable with the technology. Ultimately, he did not feel the FDA approval, rulings by a leading population geneticist, or the US geological survey were reasons to embrace transgenic ornamentals; rather it was personal reflection that allowed him to be an early adopter.

Conclusions

The tone of the interview was positive. The owner believed developing new strains of ornamental fish through genetic engineering will be “the wave of the future” and was eager to

acquire the GloFish™ from his suppliers. The pressure to be innovative manifested with the ethical dilemma of the painted fish and revealed a relationship between innovation and ethics. Since there was consumer demand for more color and he had to differentiate from large retail stores to succeed, he had to stock a product that he believes was unethical, such as the painted fish. It was evident in the interview that the participant hoped transgenic technology would make the practice of injecting glassfish with dye to create painted fish obsolete.

Product safety emerged several times in the interview. His reasoning for stocking the fish was simple and bounded by the information available to him. He did not utilize a formal protocol to assess the risks and benefits of stocking the transgenic fish, but in this instance came to the conclusion that the technology was safe because the trans-gene could not move among species. While he noted that he had never seen information indicating that GloFish™ posed a risk, he also admitted that the information available to the store and its customers is inadequate. The lack of special interest propaganda elucidating the risk may have deterred his decision to be the first store in Gainesville to sell the GloFish™.

Economics were the reason to acquire the technology and cause of concern, since extreme hype could result in loss of business from his store being picketed. He perceives the delicate balance of the relationship between hype and economics and is willing to assume the risk to draw attention to his store. The increased media coverage and hype surrounding the first genetically modified pet provided an adequate impetus to stock the fish and risk special interest group backlash. Thus, the categories of hype and economics co-mingle through the interview. If the special interest groups interfered with his business, then he would “Rue the day” he allowed the fish into his store. At the same time, he admitted that “I want them to talk a lot.”

Interview 2: The Well Informed Employee

Overview

The location of the interview was an industrial mall in Gainesville, Florida. When the interview began, the participant was in the process of conducting water changes for the fish tanks. Research interests and common contacts were discussed before the transcription began. The small talk served to make the participant comfortable and eager to share his opinions. The participant was well known and respected in the aquaculture community. He was not only involved in marine ornamentals but also had an aquaculture lease. He indicated that he had been involved in the ornamental fish industry for 20 years and had no plans for a career change. He was young, energetic, and open-minded about hearing both sides of the transgenic ornamental fish controversy.

The store sold only marine ornamentals and appeared to be in new condition. The tanks were well cared for with no signs of equipment neglect or misuse. Per subsequent conversation, there appeared to be multiple equity owners in the company. While the exact ownership percentage of the participant was not ascertained, his role in buying product, keeping product healthy, and strategizing with the other owners was significant.

The participant was highly interested in the research, demonstrated a positive affect, and was eager to learn about the preliminary findings of the study. After 30 minutes of miscellaneous communication during the completion of routine aquarium maintenance, the interview was conducted in a side office free from distractions. There was a change in affect and tone to a more formal exchange once the digital recorder was turned on.

Overall the interview went well, and it was easy to get the participant to discuss the issues, however too many leading questions were asked, such as, “So people buy based on color?” Another leading question was, “Would the reason a person not buy the fish be moral or cost?”

Leading questions and biased responses decreased the reflexivity of the study. The questions were asked to clarify issues the participant brought up in previous questions but in effect could have implanted a personal belief in the subject.

In addition, there were many yes or no questions that should have been phrased to allow more open-ended responses. “Do people have concerns about where the fish come from or if they’re damaging to the environment?” Such yes or no questions limit the range of responses and make saturating the categories of responses challenging. The function of the interview is to get the participant to talk at length about the subject without forcing any *a priori* assumptions and beliefs upon them. Fortunately, the interview was conducted at the early stages of the coding process, so modification in style could be made for subsequent interviews.

Emergent Themes

Dichotomy. A common theme in the interview was the dichotomy between accepting or rejecting products derived from genetic engineering. Participant 2 believed that people have bipolar attitudes toward the Glofish™ that were similar to “Roe vs. Wade.” He used the landmark case as a metaphor for the GloFish™ debate throughout the interview. He saw people’s beliefs on the issue to be highly polarized and steeped in morality. He explained, “We’re talking about some moral decision that the person has made based on nonquantifiable, nonvisual . . . beliefs . . . and the beliefs are delicate like “Roe vs. Wade.” Again, he reported, “And this is another one of those sticky areas where folks are divided because of what they believe, not because of what I believe is actual knowledge.”

He did subscribe to the common misconception that if people had more knowledge and “facts” they would be less likely to come to an irrational conclusion, but he does recognize that the decision to purchase the GloFish™ will be based on buying product attributes, such as coloration, rather than how they “feel” about the fish.

Ethics. Unlike the pilot study, participant 2 was not concerned about the ethical implications of genetically modifying pets. When describing his customers, he noted, that they viewed the fish as “an ornament in their living room” rather than a living creature. He admitted that the common aquarium hobbyist was not concerned about the origin of the fish or the possibility of environmental degradation stemming from its purchase. In effect, participant 2 believed that ethics had little impact on the decision to buy or not purchase an aquarium fish. Other than nature lovers, “Ninety-nine percent of the time I get ‘I want something with color’.” “No one has been able to even keep it alive. I sell three or four of them a week. Why they’re harvested from the wild I don’t know.” He described how the color of marine invertebrates can enhance their marketability: “What is the indigo pink doing to its photosynthetic capacity? You can imagine, and of course they don’t live. But they sell like gangbusters.”

The “Playing God” theme appeared once in the interview and was placed in the ethics category since it is inferred that it is hubristic and therefore unethical to genetically modify pets to have desirable characteristics. Modifying the fish through other methods, such as dying, however, is acceptable to the public. He stated, “You’re playing God by manipulating. Now if I add a little food coloring in there I’m being entrepreneurial. I’m making business. But if I manipulate on a genetic level, I’m Playing God.”

The ethical dilemma presented to the consumer and the retailer by the GloFish™ is one based on feelings rather than hard facts. He stated, “But I think that certainly there are beliefs, morals in place here that are causing the person to be in favor of it one way or another. Whether or not that is an informed decision or an uninformed one, or whether or not they even want to know, I think that people have made a decision based upon what they feel.”

Hype. Hype and economics were intertwined in the second interview. Participant 2 did not discuss the benefits of GloFish™ hype as extensively as participant 1, but there was still evidence that hype was an added benefit to the smaller retail chains. When asked why someone would sell or get involved with transgenic fish, he stated, “If the public wants these, and if it is a scuttlebutt or rumor to raise a stir or to gossip about, it brings people in the door.” Subsequently he stated, “And I think it does help out to have the novelty items.” Some of this participant’s lack of interest in hype might be attributed to his position as a retailer to marine hobbyists rather than those involved in the struggling tropical ornamental hobby. Neophytes in marine aquarium husbandry who are motivated through fads such as Disney’s Nemo movie are not perceived as valuable customers, rather one time shoppers lacking the skill and the desire to effectively maintain their aquariums. He referred to his customers as “advanced hobbyists,” but later stated, “No one can keep an anemone alive, but their kid sees the Nemo movie and wants an anemone.”

Economics. As in the pilot study, participant 2 believed that people would get involved in selling transgenic fish because of the competition. “Having competitors, the [large retail] stores, we are in business here to make business.” He did not, however, believe that the high price of the GloFish™ would have deleterious consequences on the marketability of the fish. From a marine paradigm, consumers are willing to pay considerably more than fresh water novice hobbyists. The natural progression of hobbyists is the small fresh water tank to the larger tank. Sometimes people progress to keeping marine species. He stated multiple times that the cost of the fish does not heavily influence the decision to buy the fish. “People come in all day long and buy \$100 fish here without thinking about it.” When asked if the higher cost of a GloFish™ would deter customers, he responded, “I believe it has absolutely nothing to do with the cost.”

I've been doing this well over 20 years in a retail environment, selling aquatic organisms. And cost is absolutely nothing.”

Invasive species: Painted fish. Painted fish were referenced throughout the interview. The participant indicated that painted fish had been well accepted by the industry. As well, it was obvious that people are linking the genetic modification of the GloFish™ to injecting dye into a fish's musculature. The painted fish was frequently used as a reference and another source of controversy that has emerged in the aquarium industry. Participant 2 noted that the responses regarding the painted fish were similar to those regarding the transgenic fish such as, “you shouldn't be doing that. That's not right. That's unnatural.”

Rather than viewing the technology as the threat, this participant believed the consumer was responsible for driving the development of transgenic, tattooed, and dyed fish. The painted fish concerned him more than altering the genome, but he noted that the public was more willing to embrace these alterations because it was “comprehensible . . . swallowable, digestible.” Because of the physical harm that results from dyeing the fish and the reduction in life expectancy, he claimed, “That is unnatural. It's also immoral.”

Invasive species were alluded to, but the term never manifested in the interview. “Most of the time in this hobby, there are a number of illegal organisms that we can't buy, such as piranhas and arowanas and stuff. If they got out into our environment they would of course compete with our natural organisms.” He continued to explain that the GloFish™ could not possibly be an invasive species and cause harm to the environment because the coloration of the fish would increase its visibility to predators and decrease its ability to compete with indigenous species for resources. “A blue heron could pick it off from four miles out of the sky. So I'm not worried about it becoming in competition for our indigenous or endemic organisms.”

Conclusions

The participant clearly stated his biases, “Myself, personally, I’m in favor of any scientific genetic advancement we can make. I’m fascinated by it.” The importance of having colorful fish as a decorative feature was more important to him than viewing the fish as a pet. It is unknown how much cognitive effort he gave to his conclusions, but he based his decision on a factual and tangible statistic: it has been done before, and the chances of the species introducing itself into the environment are slim. As well, he indicated that the idea of having DNA cause a mutation in the stomach of a predator was unlikely. “As far as the fish getting eaten and starting a transmutation in the animal that ate it, I think I’m competent enough to know that the digestive system of that organism would cancel any genetic mutagenic activity.”

The difference in the customer base between the pilot study and interview 2 influenced the perception of a customer’s buying attributes as well as the impact of transgenic species on the industry. Marine ornamentals by and large are harvested from the environment while tropical fish are farm raised. Over the last few years, those in the tropical aquarium industry have become concerned about the lack of drive and inspiration in the field. Meanwhile, new species and techniques are constantly being introduced in the marine sector.

The following issues manifested during the interview. First, the store was inventory strictly marine and therefore, GloFish™, a freshwater fish, was not carried. Some variance in the responses between the pilot participant and participant 2 can be attributed to the difference in market. In conducting an interview with a marine ornamental shop owner, the theoretical sampling criterion for the study grew in scope. By increasing the size of the sample population to include strictly marine aquarium stores, the diversity of responses toward the GloFish™ became broader. The decision to continue the interview was based on the belief that the participant could provide insight into the debate a tropic hobbyist would overlook. The

customer's desire to obtain color at all cost—both economic and moral—reveals a significant difference in mindsets between marine and tropical hobbyists.

A second limitation to the study is that the role of the participant in buying product was unknown. The act of purchasing or not purchasing product underlies the moral and ethical decision to provide the fish to the public. The role of participant 2, as well as the inability of the store to stock the fish in their strictly marine tanks, makes many of the questions hypothetical. Other questions, however, such as cost, color, and ethics, can be asked and the responses extrapolated to the GloFish™ example using the responses toward controversial marine species.

Finally, considerable time was spent waiting for this participant to complete a task. The small talk that ensued about the department and the research study may have had a significant priming effect on his subsequent responses. He was of course aware of the interviewer's enrollment in the University of Florida. In the future, small talk would be confined to the store's business, rather than the research. The impact of the small talk was evident when the technology question, "Can you explain the technology" was asked and his response had similar language and word use to the previous untranscribed conversation such as "micropile."

Despite these limitations, the findings from the interview indicate a differing mindset from tropical ornamental versus marine hobbyists. The economic theme was outweighed by the desire of the hobbyist to obtain an intense color. While the pilot participant indicated that the controversy rather than the color sold the GloFish™, the second participant indicated that the GloFish's™ marketability would increase independently of cost if the color was extreme. Given that the overwhelming majority of marine reef fish are harvested using less than stellar environmental practices, the people involved in the hobby are driven by default to the exotic colors, personalities, and challenge of a reef tank. The implicit cognitive dissonance about

buying a fish that could be environmentally degrading is not applicable to the marine hobbyist since all their product is obtained through environmental degradation.

Interview 3: The Aquarium Manufacturer

Overview

The initial contact to participant 3 took place via a telephone conversation. This participant had a disability that made communicating more difficult. He focused his business on manufacturing high-end aquarium and filtration units rather than retailing tropical fish, but he had an intimate knowledge of the aquarium industry. As stated in the interview, his primary income was derived from manufacturing the acrylic lobster tanks used in Publix Supermarkets™. Manufacturing aquariums was his second career stemming from his passion for aquariums. The interview took place in his office adjacent to the main manufacturing facilities in Ocala, Florida. There were a few telephone distractions, but the impact to the interview was minimal. Overall the interview was positive. He was interested in participating in the research from a humanitarian perspective, but showed little desire to discuss preliminary findings. He admitted that biotechnology frightened him, but the specific aspects of the technology that were frightening were unclear. A follow-up question should have been asked to clarify his position. “I do have some hesitation when it comes to genetic engineering.” Again, in paragraph 116, when asked about how he felt about biotechnology, he responded, “Holistically, I am scared to death of it.”

There was evidence in his discussion of sulfur reducing tube worms that he had scientific knowledge, but he admitted that his training was experiential rather than formal. “So I was trained by some of the better marine biologists out of California. They did not have it as a school class. It wasn’t available in college. But we had to go out and work right there with them and that’s how we were educated.”

Developing Families

By the third interview, several categories and themes continued to emerge from the structured interview. While the themes have not evolved into families that are grounded throughout the data, a higher level organization of codes is required. The following developing families are not inclusive of all the codes, but serve as a framework for organizing participant 03's responses with the previous data.

“Playing God.”

“Playing God” appeared in the first two interviews, but was much more prevalent in the third interview. While participant 3 admitted that he was highly religious, the affiliation of religiousness to that of the “Playing God” family is not strong. The second participant was not religious, but referenced “Playing God” during the interview, and the pilot study gave no indication that the “Playing God” theme stemmed from the participant's degree of religiousness.

From the start the “Playing God” family appeared in interview 3. He stated, “but in my mind things change for a reason or purpose. That's the evolution of something.” Participant 3 views genetic engineering as interfering with the natural evolution of a species that does not fit into the creator's concept of the world. He continued, “I mean, who are we to start changing things around for our particular needs once visually or otherwise.” The “who are we” phrase is synonymous with we should not be “Playing God” and appears again in the middle of the interview. The participant feels that scientists overstep the bounds of humanity by genetically modifying organisms. He feels that we are “Playing God” and people should not play God. He stated, “I do not feel things are there to be manipulated.” He continued, “We out here base ourselves on ethics. . . . I begin to wonder how people that are not religious would feel about some of that.” He links ethics and religion again: “Maybe they would just be so gung-ho for it because they're not religious.”

Ethics.

In interview 2, “Playing God” was incorrectly lumped into the broader ethics family. Unlike the ethics family, “Playing God” involves scientific hubris. “Playing God” can be done to better humanity and therefore can be ethical or unethical depending on the means and the ends. The delineation of the two families is obvious in interview 3 when the participant states that we should not play God. For him it is an ethical issue, but for the first two participants it refers to the processes of cutting edge scientific advancement. Participant 3 stated, “I don’t think it’s the unsafeness or dangerous as much as it is the—as much as it is should we be doing it? The ethics of it.”

There is an ethical paradox that he is unable to rectify with advancing science to save lives while potentially harming humanity. On one hand he viewed technology as “screwing things up” but then subsequently mentioned, “well there’s that argument again. Oh but we can find a cure and save thousands of people because of it.” When asked if the profits from the GloFish™ were used to fund life saving vaccinations he responded, “We always do that. We promise you if you’ll let us bring in the lot of them, this is going to be the benefit.” He viewed the GloFish™ and its escape into the environment as a potential pitfall, but saw the promise of the vaccinations as “fantastic.”

The tone of his response indicated that he was frustrated that scientific advancements came with potential pitfalls. The cognitive dilemma manifested itself following a negative response about the GloFish™. The participant did not embrace the technology, but allowed the ethical transgression to be justified to serve the greater good. He stated, “They’re (scientists) doing something that’s progressing.” While he was not ethically comfortable with the concept of engineering fish to have desirable attributes, he realized that progress comes with a price. A

subsequent statement, however, indicated that there could be other options that have fewer risks than genetic engineering, “I think there was probably other ways to . . . solve that same problem.”

In addition to the scientific ethics, participant 3 demonstrated concern for the ethics in the aquarium industry pertaining to harvesting fish from the Amazon and attempting to keep fish in captivity that have a slim chance of survival such as the rockfish and Moorish idols. It was inferred that he does not feel that the customer cares about the environmental degradation that is done when they purchase a naturally harvested fish. He asked, “Why do we keep ripping the waters with that fish and allowing it?” The participant believes that the industry is not policing itself effectively and has reservations about other retailers tainting his industry by vending fish they know will die.

Product attributes

Health. Participant 3 discussed fish health at length. He contended that the health of fish was related to investment in the right equipment, equipment that many hobbyists could not afford. The lack of desire to invest in fish health revealed how aesthetics rather than fish health dictated how consumers spend their money. According to participant 3, buyers not only selected fish based on color, but also were not willing to spend money for keeping the fish alive. He noted that salt water tanks were expensive if you did not care for them correctly; however, given his profession of manufacturing the equipment, he could be biased in his responses. Finally, survivability questions were pointed since no retailers would admit that a dying fish would be satisfactory. He noted survivability, “definitely would be at the top of the list for everybody.”

Personality. In previous interviews, personality was considered synonymous with temperament. The third interview expanded the scope of the category to include the human-fish interactions. The participant believed the personality of marine fish was far better than fresh

water fish—that they were more interactive and human. He noted, “I think everybody would rather have a saltwater tank. The fish have a better personality.” He discussed special relationships that he had with his marine fish and how he had trained one to eat out of his hand. Since he believed that freshwater fish lacked personalities, genetically modifying fish to enhance coloration would not add value.

Economics. Once again the economics of the fish do not appear to impact the buying decisions of the marine hobbyist. He stated, “And we keep selling that \$50 fish to people knowing that that fish is going to crash and burn.” While spending money on the fish was of little importance, making the one time significant investment was. According to the participant, people are unwilling to purchase several thousand dollars in equipment to keep their fish alive.

The problem is because they were not educated on how to do that in the first place. By the time that they have spent hundreds and hundreds of dollars on medications in the replacement of their fish, but the time they're ready to throw their salt-water tank out the door. They tell all their friends, ‘Oh don't ever do a salt water tank.’ So you can understand why that it gets an extremely bad rap.

His response indicates ethical paradox. While neither a retailer nor a hobbyist wants to jeopardize the health of their fish, they are bounded by the economic cost of keeping them healthy. According to the participant, the desire for color outweighs the desire for healthy fish, however, the economic cost of purchasing the “ideal” marine system is far greater than the cost of replacing dead fish.

Invasive species—Environmental degradation

Participant 3’s greatest concern was the possibility of creating another invasive species that was genetically modified. “But then again, what are the chances of this being released back into the wild so to speak, just like we have the problem with snakes, lizards, gators, being bought as pets.” Again, “Bringing in an outside fish that’s ravaging our own supply of our natural habitat. It’s terrible.” Continuing, “But then again how do you control what a kid does when he gets

home and for whatever reason, they're going to move and mom doesn't want to take the fish tank anymore so she dumps it into the canal. . . . I think that there's got to be regulations there so that we know something drastic will not change."

After his thoughts were made clear in several paragraphs, a pointed question was asked: What was his greatest concern for transgenic fish? He responded, "That's my biggest concern, yes. Right. I think you probably saw that coming through in my answer." He went on to clarify that his fear of biotechnology is really a fear about humanity. "We do stupid things. They brought the Australian pine. . . . I think that's probably where all my feeling's roots are lying as far as knowledge comes from the fact that we keep screwing up."

Regulation

An interesting theme that appeared in the interview was the role of government in regulating technologies and preventing environmental problems. Participant 3 believed that oversight and appropriate regulations could prevent mistakes. When asked about the government's role in biotechnology governance and oversight, he indicated that there could be a safety net created, but "In the meantime, I hope it's not later than sooner." According to the participant, the government regulates ex-post-facto and attempts to rectify problems rather than preventing them. He used the example of reef degradation from harvesting live coral to support his case and then explained how laws were written after a problem had been created by the aquarium industry. Regarding invasive species, he stated "Or we do something before it has a set of regulatory rules in place."

Public awareness

The public awareness theme also appeared in the interview, and the participant believed the public specifically chose to remain naive. With regard to painted fish, "I do think they care. If they were educated." He continued to elaborate on the public's apathy, "They do not know

and nobody is going to tell them.” When asked if the consumer valued the attribute or the health of the fish more, “But you know, the consumer does not realize what they’re buying or how it got that way.” Again, “To be perfectly honest about it, I have to stand with the majority of people that are not in the process of doing that engineering, genetic engineering. I don’t think they would want the fish.”

Conclusions

There were limitations to the findings since participant 3 sold neither GloFish™ nor aquarium fish. He was included in the study after a telephone conversation indicating his knowledge of the aquarium industry, his willingness to participate, and his proximity (the Ocala area). The results are included to provide an additional perspective on the subject. Second, too many leading questions were asked. While this was an attempt to clarify the participant’s viewpoints, more reflective methods should have been employed.

Unlike the first two interviews, the entire session was transcribed capturing all of the exchange. Taping the entire session revealed that discussing the statement of purpose with this participant, coupled with the knowledge of the interviewer’s academic paradigm caused a significant bias. While participant 3 clearly stated that he did not support genetically modifying aquarium species, he used significant tact to ensure that his pre-existing beliefs would be palatable.

The participant was not aware that the GloFish™ was genetically engineered. He first mentioned that he was unaware that the GloFish™ existed when he stated, “I didn’t even know that they were changing fish for that purpose to be honest with you.” Again, halfway through the interview he admits, “I had no idea that they were engineering fish.” Since the concept of genetic engineering was introduced in the interview, there was not adequate time for the subject to develop opinions and deepen his knowledge of the subject. While he did not realize that the

GloFish™ had been created by scientists, he did acknowledge the transgenic Salmon, but asked for clarification and additional information on the subject. People generally resist change and attempt to debunk new information which is in conflict with their previous paradigm. Since there was not adequate time for the participant to develop a cohesive opinion based on the new information, his responses are a litmus rather than a detailed indication of his opinions.

Finally, the interviewer could have done a better job of reducing the digression. Twice, participant 3 redirected the interview to the immediate. Greater leeway was given to participant 3 to encourage dialoging. Rather than asking pointed and leading questions, the participant was allowed to lead the interview. Greater effort should have been taken, however, to avoid unrelated subjects like Publix™ lobsters or transgenic salmon.

Interview 4: The Laconic Employee

Overview

The fourth interview was the outlier and involved a laconic participant who proved to be the most challenging participant. He was younger, neither an equity owner nor a senior manager. As well, he had no buying influence despite having worked in the industry for 8 years. He did have an understanding of consumers and was aware of the major suppliers and producers in the industry. Introducing an employee to the sampling pool provided an additional perspective to the study. The interview revealed the dynamics that occur between a nonequity owner employee who is not compensated for selling the fish and an ornamental fish consumer. While this deviated from the theoretical sampling strategy, the boundaries of the theory were tested by including an individual who had no financial incentive to sell the fish.

Other factors could have contributed to the difference in his responses. First, the participant did not exhibit extensive scientific knowledge of the aquarium industry. The previous participants had extensive knowledge about species lifecycles, water chemistry, and

taxonomy, while participant 004 was not as articulate and did not spout off scientific names. He was neither interested in the sciences nor educated beyond a high school degree. The soothing sound of the aquariums rather than the challenge of keeping fish drew him to the industry.

The interview took place in the Agricultural and Biological Engineering building rather than the office. The impact of the interview on the participant was profound. He was not eager to elaborate on the questions and exhibited a negative affect throughout. While in a departmental conference room, he was guarded and his concerned affect resembled that of a patient in an experiment. The fact of the stipend contributed to his desire to participate in the study. Unlike the previous interviewees, the promise of financial compensation influenced his decision to participate.

Families

Painted fish

Painted fish emerged from the interview without any leading questions. The participant did not appear to be morally opposed to dye injection, but believed the product was faulty since the color faded over time. He explained that one of the first questions that customers asked about the GloFish™ was if it would lose its color over time. He responded, “They’re just worried about whether or not the colors going to die off or not.” Later he shared his sentiment on the painted fish, “I don’t like to carry them because obviously they lose they’re color.” He elaborated, “We make it a point to tell the customers that the painted fish are obviously injected with color because we don’t want to steer our customers wrong.” Ornamental fish consumers are Machiavellian; the ends justify the means. Customers did not care about how the fish was created, where it came from, or if it was harmed or harmful, as long as it had attributes, generally color, that they found desirable.

When a leading question was asked as to whether people were concerned if the fish was harmed in the dying process, the participant responded, “Well, that’s usually their main concern.” It would have been unlikely that he would have specifically stated that his customers do not care if the fish is harmed. Since a leading question was asked, the response should be mitigated. A second interpretation of the response could be that survivability, measured in harm to the fish, could be a secondary desirable trait along with color. Thus, it is the loss of the desirable attribute, survivability, rather than the knowledge that the fish is harmed, that causes the customer to question their purchase.

Customers recognized that neither the painted fish nor the GloFish™ occurred in nature, so the painted fish provided a priming effect since it has been on the market longer. The impact of the painted fish on the GloFish™ was profound and set a negative stage for the introduction of future lines of transgenic fish. When asked to compare or contrast the painted fish and the GloFish™, the participant mentioned that people buy the painted fish despite his warnings and return upset when the colors fades. Similarly, he stated “I haven’t had anybody come back yet with the GloFish™ and tell us that they were disappointed in them.”

Product attributes

The impetus for the fourth interview was to populate the consumer attributes categories of cost, color, and personality and determine the impact of the painted fish to the public’s perception of the GloFish™. Numerous questions were asked about what drives a customer to buy the fish and why the store chose to stock it. Ultimately, the reason appears to be economic: a product the consumer will purchase. Just as in the previous interviews, color was the primary product attribute sought by the customer, although, other product attributes such as, survivability and cost emerged as the impetus for purchasing a fish. When the participant was asked, “When customers are buying a fish, what attributes are they looking for,” the participant responded, “It’s

the color.” In fact, color appeared throughout the interview in paragraphs 041, 101, 108, 202. “We had a couple of customers ask how they got their color but they have never really asked. They wanted them because of that.”

An additional product attribute was personality. “Pretty much their main concerns are, if they can get along with the other fish that they have in the tanks already.” Personality, however, in this instance is in the context of survivability. A follow-up question was asked about survivability versus personality and he responded that it was the customer’s concern for the survival of the fish rather than personality. He clarified the difference between personality versus survivability. “Well, we usually have little signs on the tanks and it’ll tell you if they’re a community fish, if they’re nonaggressive or aggressive.” In an attempt to rank the product attributes in order of importance, a leading question was asked, “(Do) you think they would be more likely to buy a Plocostumus because it won’t die, than a fish that has maybe fancier colors, than a Discus that’s more difficult to take care of?” He responded “Yes,” but the phrasing of the question may have biased his response. Ultimately, consumers are concerned about the loss of their acquisition and the general health of their aquarium. Tropical fish consumers, unlike marine consumers, appear to be driven by a survivability component that outweighs the color attribute.

Like other interviews in the tropical fish sector, this participant viewed the high price of the fish as a negative characteristic. This could be attributed to the store’s focus solely on tropical rather than marine fish which are considerably more expensive and less commoditized than tropical fish. Cost issues appeared in multiple paragraphs. The respondent explained that to make a margin similar to what can be expected of nongenetically altered fish, the price becomes

higher than the tropical fish market will bare. With close substitutes, such as the nonengineered danios costing \$0.79 rather than \$8.00, the GloFish™ is a more difficult sell.

Well, when we buy them, they buy them at \$2.00 a piece because we sell all of our fish at usually three times what we pay for them. That could be a big issue. Obviously it's something they take time to make, and usually go for a lot more to sell them. I think if we sold them at like maybe \$3.50 or \$4.00 a piece they would go a lot faster, but that means we would have to buy them at \$1.25 a piece.

Ethics

The ethics category also was evident in the interview. Despite the fact that the participant admitted that he was not very religious, he mentioned that some scientists “Think that they're God and create what they want to.” The participant expressed confidence in the government to regulate the technology, while having reservations about using the same technology to lend attributes to higher level vertebrates. When asked why he felt the technology was safe, he answered, “I know it's safe or else they would not be doing it.” Additional follow-up questions about what makes him feel the governance is adequate should have been asked.

When asked if he was skeptical of the technology he responded, “It bothers me to a point but it doesn't bother me. They're neat to look at, but there has to be a certain cut off point where they shouldn't mess with things.” Morality issues, however, emerged with higher vertebrates. Plants, and fish were considered morally acceptable with regard to modification, while “dogs and stuff like that” were not. He mentioned that Dolly, the cloned sheep, was unacceptable because sheep had a “heart” meaning sheep are more advanced creatures. This statement resembles the Belief in Animal Mind (B.A.M.) theories for hunting and meat consumption. According to B.A.M. theories, people are more reluctant about hunting animals they believe have self-awareness. Thus, participant 4 was opposed to genetically modifying animals that would be aware that they were somehow altered. When asked about his overall impression of genetic engineering, he responded, “It could go either way. It just depends on what they are trying to

create.” It can be inferred from this statement that he does not perceive the GloFish™ as socially beneficial. He would, therefore, be more accepting of genetic engineering if the benefits would “help us out.”

Comparative Analysis

Several categories did not emerge in the interview. First, unlike the previous three interviews, neither environmental degradation nor invasive species emerged as a theme. When prompted about invasive species, this participant admitted that it was a concern, but he never stated that the GloFish™ could cause environmental harm. He used oscars as an example of an escaped aquarium fish, but placed the blame on the consumer and the retailer for not taking responsibility for the fish. He viewed invasive species to be a consequence of aquarium retailers trying to make a “fast buck” and consumers being duped into purchasing a fish that would outgrow their smaller aquarium. He never mentioned the possibility of environmental degradation, but when prompted, he acknowledged that the GloFish™ should not be released into the environment.

Second, the category of economics did not arise in the interview. The previous interviews involved equity owners and managers, and considerable dialog emerged about how the GloFish™ impacted business. The economics theme was differentiated from the product price attribute. While the participant did discuss price, he did not mention the economic impact of the GloFish™. Rather than focusing on the business, this participant focused on pleasing the customer, a characteristic that can be attributed to his position as an employee rather than an owner. Finally, since there is a relationship between hype and economics, it is not surprising that hype was never mentioned as being beneficial to the industry. The variance in the participant’s paradigm as an employee versus an owner accounts for the missing category.

The participant's reservations towards the GloFish™ and genetic engineering were emotionally driven. He did not state a clear reason for why he objected to genetically modified fish. The extent of his conviction and the sources of information that he used to develop his opinion were unclear.

Of the previous three interviews, interview 4 was the weakest due to the difficulty in prompting the participant to elaborate upon his responses. The participant's short responses did not lend themselves to the constant comparative method. As well, leading questions biased the data and drove the participant to respond based on a-priori assumptions. Mention of the painted fish and Dolly were the only instances when the participant introduced media themes without prompting.

Conclusions

The fourth interview indicates that consumers want a colorful fish. Product attributes, rather than morality, drive buying decisions. The ornamental fish store carries the GloFish™ as a function of profitability, and the employees sell the fish without any moral reservations. While ethics emerged as a category, it appeared that the GloFish™ was acceptable because it already existed. The participant did have concerns about the extent to which genetic modification should take place and what social benefits could be realized. He mentioned cloning (Dolly) and expressed concern whether or not scientists should be manipulating the genomes of higher order vertebrates. The lack of dialog surrounding the business is attributed to the position of the interviewee. He did provide considerable dialog from the perspective of an employee trying to provide solid customer service.

Interview 5: The Marine Enthusiast

Overview

The fifth interview was carried out in a marine ornamental shop. Several phone interruptions and the public location at the front desk of the shop did not impact upon the results negatively. Overall, the participant was eager to participate in the study and asked numerous questions. He was knowledgeable about the aquarium industry, but less knowledge about GloFish™, biotechnology, and the trends in the tropical ornamentals sub-sector. Participant 5 did not have a strong scientific acumen, but had extensive practical working knowledge of the marine ornamental industry. His affect was positive and he did not want to accept payment for his participation.

Although positive in his affect, this respondent possessed an element of skepticism that stemmed from the researcher's involvement with the university and enrollment in the department of Agricultural and Biological Engineering. The participant sold only marine ornamentals, but admits that he would sell genetically modified fish under the right circumstances. While he did not outrightly object to genetically engineering ornamental fish, he had reservations about the FDA and the unknown long-term consequences of the practice.

Considerable effort was devoted to assessing the participant's trust in the regulatory system given his negative feelings toward biotechnology. While several questions were asked about consumer attitudes and product attributes, additional questions to determine the boundaries and taxonomy of color, cost, and personality could have been asked.

The fifth interview was marked by the act that the primary force driving the respondent's decision to sell or not sell the fish was economic rather than moral. There are instances when retailers refuse to stock a product independently of the potential profit. The stocking decisions of ornamental fish retailers are functions of their customers' desires as the stores exist to make a

profit. While there were instances, such as was found in the pilot study, when retailers refused to stock painted fish because they were morally opposed to a process that causes death, the GloFish™ does not appear to push the moral boundary. If the fish was injured, died, was somehow weakened, or in any way harmed by the process, then the retailers would be much more likely to avoid stocking the fish based upon both moral and quality concerns.

Cost is not linked to business acumen, but can be attributed to variations in customer bases. While cost was reported as a great concern in the pilot study, it impacts the tropical fish sub-sector rather than the ornamental fish industry as a whole. The decision to stock or not stock the fish is not based solely on cost, but a battery of factors that determine the marketability of the fish.

The interviews show there are subtle differences of opinions regarding what the GloFish™ represents in the ornamental industry. The range in responses from the previous participants can be attributed to their sectors in the industry: marine, tropical or mixed. In addition, the impact of painted fish upon the consumer's perception of an artificially created fish is significant. Painted fish have had a significant priming effect on both consumers and retailers. Because they are harmed during the painting process, the public's immediate assumption is that the GloFish™ are injured as a result of the intense coloration.

By the fifth interview, the researcher became interested in the sources of information that were utilized to develop opinions. From the first four interviews, mass media as well as dialog with other retailers emerged as the primary sources. The involvement of the retailers with special interest groups with anti-biotechnology agendas needed to be ascertained, so an additional question was asked about participant involvement with any political action groups

such as Green Peace. The fifth interviewee reported neither being affiliated with special interest groups nor a fan of their anti-biotechnology campaigns.

Product Attributes Family

Personality, color, and cost were again the most desirable product attributes. When asked what characteristics made most marine fish marketable, participant 5 responded, “Mainly color.” Color drives a retailer’s decision to stock the fish, secondary to personality. In the marine sector, color supersedes the health and life expectancy of the fish. While price is a driving force keeping tropical fish retailers from stocking the fish, price has not yet been mentioned as a factor in the marine sector. Following the trend, price was not an issue for participant 005. While he admitted that there were occasions when the price of a fish reduces its marketability, it is an exception. Regarding price he stated, “Yeah that’s a big thing, but then there are people out there that really don’t care about the price of the fish.”

He also indicated the importance of personality. When a clarification question was asked, color and temperament were more valued by the consumer than the cost of the fish. There are two types of personality: personality in terms of interacting with the owner to form a pet-owner bond and personality in terms of survivability. Participant 5 focused on both, but his reference to temperament rather than personality indicates that he is referring to the fish’s aggressive characteristics resulting in loss of life.

Ethics Family

The ethics category emerged immediately. Participant 5 stated that he would not knowingly sell a fish to a customer if he knew, “that the fish will not survive in their tank.” The tone of his response indicated that he believed competitors would sell anything they could profit from. The profit versus ethics paradox appeared again when the respondent discussed dying corals and anemones to provide additional coloration to enhance product attributes. He admitted

that if the market demand was there, and he needed to make a profit, he would sell the fish. He stated, “If I sold freshwater, if the demand was there, I would probably have to” sell the fish. His response indicated his reluctance to embrace the new technology, but the desire for profit would outweigh his ethical concerns. When discussing the roll of larger businesses in stocking the fish, he stated, “Yeah, I can see that on a business end; that is why I was thinking [big retailers], those guys, would be all over it. Just in my mind, as a business.” He believed larger businesses would be more inclined to stock the fish because they perceived only profit. That is, big business lacks morals that smaller stores have against stocking a product that they do not approve of.

All five participants acknowledge that they would sell GloFish™ if the consumer demand was present. Since selling is a binary function—the fish is sold or not sold—quantifying the desire to sell is difficult. While participants 3 and 2 had the greatest concerns, all respondents acknowledged that they would sell the fish to make a profit. Thus, the Business Paradox emerges: The retailers feel that they must sell a product to survive. Participant 1 happily sold the GloFish™ but refused to sell painted fish. However, if the retailers sold the painted fish, there have been no objections to vending a genetically altered product. Participant 2 admitted that if you dye a fish you are “entrepreneurial,” but if you change the genome, then you are “Playing God.” The point where the retailer refuses to stock a product is elusive. Selling a fish that they know would die seems to be the cutoff.

Finally, participant 5 acknowledges that genetic research for medical advancement must take place to provide cures for diseases. He understood that many technical advances carry significant social risks. Like other participants, however, he did not believe the social reward resulting from taking the risk of genetically modifying an ornamental fish for market purposes was justifiable. He stated, “Yeah, but then again, it’s all a part of going back to the DNA, and as

a scientist working with DNA, that's got to be something that needs to be done ... like to lower the risk of cancers, heart disease, or Alzheimer's." While participant 5 was not comfortable with scientists creating the GloFish™, he recognized the importance of the event for scientific advancement. His inconsistent perception of the GloFish™ and biotechnology in general can be summed up by the following response: "Overall I think it is a good thing, and it's probably something that has to be done, mainly for the future of our race, and life in general. Some of it is kind of wishy-washy in ways and I guess you could say a little frightening in other areas."

Jurassic Park Effect Family

When questions were asked to determine the boundaries of his morals with regards to biotechnology, he was more concerned about the fear of the unknown rather than a moral quagmire. The Jurassic Park effect refers to the fear of the unknown and scientific hubris. The phenomenon appeared in the five interviews in various forms with fear of the unknown the most common. Participant 5 believed there would be scenarios that the scientific community failed to consider that would result in a biotechnology calamity. Early in the interview, the participant asked about the long term effects of the fish. While he did not mention an invasive species, he was concerned about the unknown long term consequences of genetically modifying fish. A second question could be interpreted as concern for invasive species or the idea that scientists will lose control over their products. He asked, "So you don't think that they could multiply in the wild at a rapid pace?" The fear of the unknown, or the Jurassic Park effect is revealed when participants admit that they have concerns about the long term consequences of manipulating nature. "Nature will find a way" to cause trouble.

The effect impacts this participant's trust in the regulatory system. When he was asked what would have to be in place for him to sell the fish, he responded that it would take more time to rule out other unknown factors before he would be fully comfortable with selling the GloFish.

Regarding selling a transgenic fish he responded, “No, I can’t say I wouldn’t do it just based strictly on ethics, but I think [there needs to be] just more research and more time, the longevity of the genetics going on.”

The phenomenon is revealed after responding to his question regarding how long the technology to genetically modify fish has been in existence. He responded, “For example, 15 to 20 years down the road, one gets in a pond and what happens if they start sprouting little tentacles . . . like the anemone, I mean the possibilities . . . everything evolves to environmental conditions . . . we just don’t know.”

His fear of the unknown also impacts product attributes. The participant expressed his concern that genetic modification to create one enhanced product attribute, such as color, could impact upon other such desirable attributes as calm temperament. “It’s mainly, for example, we know about *perculas*, we know their temperament, their behavior, how do we know that this genetic modification is not going to alter any of that.”

The Jurassic Park phenomenon exemplifies the role of mass media in priming the audience. Fear over scientific advancement has existed for millennia; fear over biotechnological advancement, however, is a recent phenomenon. Close substitutes would be the fear of nuclear power or the creation of something in a laboratory that could not be controlled.

Regulation

Numerous questions were asked about the participant’s knowledge of the regulatory system due to his negative perception of biotechnology. While trust in the regulatory agencies corresponded to a positive perception of biotechnology, there were other factors impacting the participant’s desire to stock transgenic fish. He did not trust the regulatory system, but the impact of this lack of trust can be isolated from other moral and product attribute concerns. When he was informed that the FDA was spearheading the governance of the GloFish™, he

responded, “Oh well that leaves it wide open.” While he could not describe an event that made him question the efficacy of the FDA, his disapproval of the FDA extended to a dislike for all government. He believed the government does not do an adequate job of policing foods, drugs, and supplements. He remarked, “No, it’s just a lot of things with total government. . . . I think they could do more to regulate.”

When he was asked if there was an agency that would do a better job, he believed that an independent board of scientists would be more capable of regulating biotechnologies. His assumption was that the FDA was political rather than scientific. As well, he believed the FDA was corrupted by governmental influences while a scientific board would be less biased.

Comparative Analysis

By the close of the fifth interview, enough data existed to merge themes and codes into families. The ethics, product attributes, regulatory and the Jurassic Park effect families were created. The ethics family constituted instances where a nonempirical higher purpose drives reasoning. This includes themes and codes such as “Playing God,” environmental concerns, and morality. The ethics family continued to be a primary driver in retailers’ responses toward transgenic products. The fifth participant understood that scientific advancement comes with social costs and justified advancements where the benefits to society outweighed the risks. The ethics family also addressed the moral paradox of selling the painted fish while not selling the GloFish™.

The family of product attributes was created out of discussion surrounding what make consumers value a fish such as cost, color, longevity and personality. There was a variance in the ranking of importance of the attributes, however, for marine and tropical retailers. Tropical retailers consistently described the price of the fish, following color, to be the most important attributes. Likewise, marine retailers reported that the customer was seldom concerned about the

price of the fish, but the coloration of the fish was their greatest concern (Table 4-1). Finally, the Jurassic-Park effect family emerged from codes addressing fear of the scientists, scientific hubris, fear of consequences, and Hollywood's impact on the public's perception of biotechnology. All five respondents reported concerns about the unknown regarding genetically modifying fish. The invasive species codes were also added to the Jurassic Park effect family. The fear that a nonindigenous organism can be introduced into an environment and thrive should be placed at the core of the Jurassic Park effect family.

Interview 6: The Flamboyant GloFish™ Lover

Overview

Participant 6 did not have a storefront, but operated an aquarium service business focusing on tropical freshwater tanks. His service contracts included routine maintenance and purchasing fish for his customers. The interview was conducted at a restaurant in Ocala rather than the participant's office. The change in venue's impact on the participant's responses was minimal. The restaurant setting was free from distractions and did not add additional biases. Initial contact was made by telephone and time and place were established. The interview was conducted in the morning while he was in the process of assisting his clients in downtown Ocala.

Several actions distinguish participant 6 from the others. First, he was the only participant to offer a gift as a token of his appreciation for being included in the research study. The gift was an agatized coral, a rock collector's specimen, not high in monetary value, but meaningful to the research. The gift indicated his eagerness to participate in the study, and prompted concerns that he might answer the structured interview questions to please the interviewer. Deciphering the extent of the interviewer's impact on the participant was difficult given the pattern of his responses. It was evident, however, that he was eager to participate in the study and pleasing the interviewer with correct answers appeared to be important. He was more eager than all the other

participants in preparing for the interview. His positive affect indicated that he enjoyed his work and had a large amount of intellectual curiosity. After the interview time and location was established, he asked what he needed to read to prepare for the interview. He was the only participant to telephone the assistant and make additional inquiries as to the types of questions that would be asked in the interview. This behavior again indicated his eagerness to please the interviewer.

Overall, the participant was the most avant-garde in the belief that the research was promising, both in the marine industry and also in the broader agricultural biotechnology sector. He was highly optimistic about the promise of biotechnology not only toward reinvigorating the ornamental industry, but also toward helping develop alternative energies and foods. His only reservations in regard to the ornamental industry were invasive species, but he did not have concerns about transgenic escapees becoming established in native environments. He opposed the painted fish, and physically harming animals, and he drew a clear distinction between tattooing a fish to provide additional coloration and altering a fish's genome to enhance protein production in the musculature.

Product Attributes Family

Personality and price emerged in the interview without pointed questions. When asked what people look for when they are buying fish, he responded, "Personality most of the time. That's how I sell it." The participant valued personality because his customers often maintained tanks in business settings, such as doctors' offices. To keep his customers happy, he had to stock his customers' tanks with fish that would be visible and move constantly.

While his clients were not interested in the cost of the fish, he did mention price as an important criterion. He was asked what he had heard about the GloFish™ from other colleagues and retailers and answered, "Since I've talked to you, it's just the price of them. The two pet

shops that I deal with are small mom and pop pet shops and they just don't like spending \$2.50 to get it in the shop."

When he was asked to rank the importance of color, price, and personality in a direct question, he responded, "Color, personality, price." Since he is buying fish for his customers, he evaluates the characteristics differently. While this ranking varies from the previous tropical fish retailers' responses, the ranking was identical to that of marine retailers' responses. The ranking can be attributed to his unique customer base. Participant 6 could be categorized as a tropical fish retailer since he stocked his customers' tanks with fish, but his customer base could afford to have a full time service to maintain their tanks, and therefore, would not be influenced by the price of the fish.

Ethics Family

Unlike the first five participants very little of the transcribed dialog was placed in the ethics family. While he was a religious man, exemplified by his admission of tithing to the church, the "playing God" code was never used in coding the interview. He was totally comfortable with biotechnology and the products developed with the technology. As well, participant 6 did not have ethical dilemmas stemming from his work. He never mentioned that genetically modifying a fish would unethical, but the boundaries of his response were unclear. When asked what his impression of biotechnology was he said, "As much as possible." Implied in the response was that genetic engineering was a great technology that should be used to better humanity under every circumstance. The tone of the interview was highly optimistic, with the exception of describing biotechnology opponents.

He did, however, insinuate that the painted fish was produced by unethical means. He described how a painted fish is created. "There's actually two ways. They can actually paint them with a brush . . . and you can see it on the outside of the skin or . . . they inject it under the

skin . . . you have a glass fish 6 to 8 months and then they end up dying.” He elaborated on the limited survivability, “You don’t get more than a year out of a painted glassfish. I’ve never seen one live over a year. I’ve never seen the paint last more than 6 or 7 months.” While he did mention the mortality resulting from the procedure, he never explicitly stated that he believed it to be immoral.

Jurassic Park Effect Family

The Jurassic Park effect family did not appear frequently, except for dialog about invasive species. Participant 6 perceived people who feared that scientists would create something that they could not control as unrealistic. “Every time they try something crazy, it usually doesn’t work . . . they always think the blob’s going to be formed . . . and it’s just not going to happen.” When he was specifically asked about the Jurassic Park effect in the context of “nature will find a way” to survive, he responded that it was highly unlikely if not impossible. He recalled his experiences at the University of Florida, “I used to mix all kinds of stuff up at UF; you wouldn’t believe some of the stuff that we did with rice and stuff, rice and orchids. Even if it comes out, it’s not going to be this thing that takes off.”

Participant 6 discussed invasive species at length, but did not indicate that they were of significant concern to him. At one point in the interview, he admitted that he went as far as to stock his customers’ koi ponds with snake headed fish. He believed that invasive species were a fact of life, and that very little could be done to stop the introduction of nonindigenous species. When asked if increased regulation could prevent their spread, he responded, “I don’t think you could regulate either . . . they could walk in their back yard and dump the aquarium in a pond.”

His in-depth discussion of invasive species was not attributed to concern, but resulted from the increased media coverage in the same period. During a preliminary phone conversation before the interview was conducted, the participant asked if the study pertained to invasive

species. He began the interview by stating “I’ve just been doing a lot of research on that down in the Everglades . . . had just watched a whole show on that.”

Comparative Analysis

The most significant difference of interview 6 from previous interviews is the level of confidence in the regulation of biotechnologies. The participant’s responses to the questions pushed the boundaries of the ethics, and the Jurassic Park families. As well, participant 6 was the most pro-biotechnology and had faith in scientists and the government to do what was best for humanity. He firmly believed the risks to the environment and humankind were minimal. As well, very few of his responses could be placed in the ethics family.

The product attributes he mentioned were in line with other responses. The primary product attributes continued to be color, personality and price. Unlike the first participant who believed the GloFish™ was a boon to small retailers, he believed the cost of the fish was a barrier to entry for “mom and pop” retail stores. While he ranked the product attributes importance in the same order as a marine ornamental fish retailer, the difference can be attributed to a wealthier customer base. Without prompting, he mentioned personality and price to be the most significant criterion, yet color emerged as the number one product attribute after it was stated by the interviewer.

Unlike all previous participants, participant 6 did not discuss the GloFish™ in the context of morality and ethics. He exhibited the least amount of ethical concern about the practice of genetically engineering plants and animals. Since he believed scientists and the FDA looked out after the interest of humanity, he had a *laissez faire* attitude regarding how, what, or when biotechnology should be used. He was the first participant to place the onerous of establishing ethical and moral boundaries into the hands of stakeholders. The participant believed scientists would establish their own boundaries for the technology using their own moral compasses.

The painted fish, a member of the ethics family, was discussed at length by Participant 6. Participants 2, 3, and 4 had significant concerns selling a fish that they knew would die, but sold it anyway. While the painted fish concerned him, he never specifically stated that he would reject selling the fish. Thus, it was unclear if participant 006 would stock the fish in his customers' tanks.

Finally, participant 6 was the least affected by the Jurassic Park effect. He neither exhibited significant fear in the unknown nor believed that scientists would create something that they could not control. The minimal influence can be attributed to his trust in humanity as well as his perception of risk. He understood that there were two components to risk, the probability of the event happening and the consequences of the event. His trust in scientists, the FDA, and government along with personal laboratory experiences made him realize that the second part of risk, the probability of an event happening, was minimal, and therefore biotechnology posed a small risk to humanity.

Interview 7: The Centrist

Overview

Participant 7 was knowledgeable about the GloFish™ debate, and had 36 years of industry experience. Considerable effort was made to determine the boundaries on the conditions determining whether or not he would be willing to sell the GloFish™. Unlike other participants, he mentioned that he had customers who specifically requested transgenic fish. “We have had some, not a lot but people come in looking for them. They call them the GloFish.™”

Participant 7 sold both freshwater and marine fish and routinely read trade journals and publications. He had a neutral affect throughout the interview, but he did not participate in the interview solely for the financial stipend. Participant 7 understood the risks and benefits of creating transgenic fish. He neither embraced nor rejected the technology. He explained, “I

would have to say I'm not for it and I'm not against it. I'm down in the middle. They can build some things that may help mankind and then they make things that destroy mankind. It's bad and good. I'm not for it and I'm not against it."

The previous ranking of product attributes, color, price, personality, held in the interview. While the participant did have some reservations about the extent to which genetic modifications were made, and reasons for the modifications, he embraced the GloFish™ as providing tropical fish enthusiasts with an alternative to marine species. The Jurassic Park effect did not have a deleterious impact on his perception of the GloFish™. Rather, he viewed it as a self regulating natural function that returned anomalies back to stasis. Finally, his ethical limitations were delimited by the type of organism engineered and what social benefits stemmed from the modification. He did not perceive genetic engineering as dangerous, but rather unnecessary for certain products.

Product Attributes Family

Once again, the favored product attributes were color, price, personality and survivability. The participant mentioned color five times in the interview as the primary sales attributes, but also noted that survivability factored into the buying decision. Price, however, remained secondary. When asked if price was an issue, he responded, "Not really, they look at the price and they accept it. They go more for the look than anything else plus the fact they are very hearty fish." The product attributes family has become fully saturated at this point and, therefore, should be considered a category. While there is some variation in the pattern of responses regarding the importance of cost to the buying decision, the importance directly relates to the store's consumer base and whether the store offered both marine and tropical ornamentals. Survivability, while a consideration, was consistently secondary to color.

Participant 7 was asked what attributes should be engineered in the fish and he responded, “I think if they wanted to do something for animals I think most of it would be color in the retail aspect. People love color. People go down our last aisle of salt water and are like, whoa, I want that! I think it is color.” While he clearly believed color was the primary sales attribute, the importance of survivability to the consumer was stated. “They go more for the look than anything else plus the fact they are very hearty fish.”

Ethics Family

Participant 7 had no ethical problems with stocking the GloFish™. While he admitted that he was a “fish purist,” he understood that the fish was not harmed in anyway. He mentioned, “Some people are purist. I’m a purist myself. I like pure fish.” It was unclear from the interview whether he would personally own transgenic fish, however, he believed ethics was the driving force keeping retailers from stocking the fish. He noted,

The big chains will not carry them like PetSmart and Pet Supermarket. I don’t know about Petco because Petco carries saltwater fish but I don’t know. PetSmart and Pet Supermarket won’t carry them because they believe it’s an ethics thing. The bigger chains won’t carry it. Some individual stores may not carry it because of the ethics thing and it’s an aberration. I think most of them won’t.

The painted fish was discussed, but not in the usual context of ethical dilemma. He had little to say about the ethics surrounding the painted fish. He mentioned that the glassfish was a close substitute for a consumer, “They will go to a neon tetra or plecos or blue gouramis and some painted glass fish.” He did not criticize his customers for buying a glass fish and did not exhibit any concern for selling a fish.

Participant 7 understood the linkage of the GloFish™ to the broader agricultural biotechnology debate, and noted the social benefits of using genetic engineering. He accepted the risks and understood that all new technology comes with potential pitfalls. The boundaries of what he was willing to modify for social gain were examined. He believed that fish were the

only vertebrate that should be genetically modified. The reason for the concern was unclear, but could be attributed to the fact that he did not see any potential advantages in using the technology for such ends. He believed that genetic engineering should stop with fish. “Most other animals, they don’t need to do anything to them. . . . I wouldn’t do it. I’d stop at fish. You can do fish like salmon and stuff.” Subsequently, a leading question was asked if genetically modifying a cow to create a vaccine would be acceptable and he responded, “yes.” This response indicated that he was interested in the social benefits from the alteration. Thus, new products could be created from other animals if the social benefit was great enough to justify the risk.

Jurassic Park Effect Family

The Jurassic Park Effect had a moderate impact on participant 7. He had a fear of the scientific community and broader humanity. The participant noted, “I think humans make this unsafe because you get like a mad scientists. Let’s mix and this and this and see what it does.” His concern about using the technology to harm humans was noted again, “I wouldn’t do it or you will make something worse than it is. We found that out. Dolly was cloned but she fell apart.”

While he did not trust humanity, he did believe that regulatory agencies were empowered to protect people. When he was asked when it would not be acceptable to genetically modify an animal, the participant responded, “It would have to be controlled. The FDA would have to do that. FDA and USDA would have to work with that.” The participant did not believe the FDA was the ideal agency to be tasked with regulating the GloFish™; he believed the USDA and the Fish and Wildlife Agency should have the responsibility. This concern did not alter his decision to stock the fish. He believed that regulation was necessary, but understood that government

agencies would not be able to regulate the release of ornamental fish into nature. Thus, he had more trust in humanity than he did in the ability of governmental agencies to police hobbyists.

He had a unique perspective on nature's perseverance to survive which mitigated the impact of the Jurassic Park effect. He viewed nature's will to survive as a way of regulating human mistakes. He mentioned the introduction of invasive species in Florida waters and the Nile perch in Lake Victoria and the return to the natural equilibrium. He elaborated,

I'm going to quote Jeff Goldblum from Jurassic Park; nature finds a way. Believe it or not, it will. I think it will survive. I think it could happen. You have fish with wild colors that do survive. It's the nature of evolution. You have fish that are cave dwelling animals and lose their pigmentation. They don't survive long in the wild but I'm sure there are some that do survive. I had an albino squirrel that survived over by my house. He had to fight for his thing because he wasn't a natural. I haven't seen him this year yet. It's the thing of natural selection.

For other participants, the fear of not being able to control nature contributed to their rejection of genetically modified products. Likewise, participant 7 viewed the nature's drive to survive as a way of preventing environmental cataclysms.

Comparative Analysis

Participant 7 was labeled as "The Centrist" due to his moderate conviction towards the GloFish™. Participant 7 had several years of college level course work in science, and while he did not have a degree, he had one of the best understandings of genetic engineering. Out of the first seven interviews, he was the least polarized in his convictions. Another differentiating characteristic of the interviewee was his tone of disappointment regarding the GloFish™. Participant 7 had believed the hype surrounding the GloFish™ would be a boon for the industry; however, the slow sales of the fish indicated that it did not live up to its promise. While in early interviews hype was an important criterion in attracting new customers, by the seventh interview, a year had passed, and the retailer's tone indicated that the fish failed to meet his expectations. When he was asked how long he had carried the fish, he responded, "We've been getting them

off and on, Seagrist and 5-D have been on the market for over a year, and we've been carrying them off and on for just over a year. The reason why that is initially the transgenic fish were supposedly the revolutionary thing.”

The product attributes category remained consistent in interview 7. The participant discussed the importance of color throughout the interview. Survivability was mentioned in the interview, but was secondary to the physical attributes of the fish. Unlike participant 005 who was interested in creating disease resistant fish, participant 7 understood that color was a superficial attribute, unlike health, that would directly influence the consumers' buying decision. While color was an acceptable use of genetic engineering, altering personality was not acceptable to the participant. The product attribute of survivability was added as a dimension, along with color, price, and personality.

Examining the product attribute of survivability presented unique difficulties, since no participant would admit that their customers did not value their pets' lives. Without prompting, survivability was mentioned in interviews 1, 4, 5, and 7 revealing its high ranking as a product attribute. The prevalence of survivability as a product attribute indicated that the boundaries of the criterion, outside of the ethics family, should be evaluated. When color was mentioned, however, there was considerable dialog, but the ranking color related to survivability was unknown.

The economic theme, while downplayed in the interviews 2 thru 5, should be an additional family. As in interviews 1 and 3, the distinction had been made between cost and price. Retailers valued cost which was placed in the economic theme, while customers valued price which was placed in the product attributes theme. Participant 7 reported that the cost of the fish was the primary reason retailers would not stock the fish. He reported that after ethics, “I'd have

to say cost next. These cost over \$5.00 if we do a mark up. It's not color." During interview 6, the participant also reported that high cost of the fish prevented its rapid adoption by small retailers. Participants 2, 3, and 5 specialized in high value product, so the business strategy focused on the profits rather than the cost of the fish. Participant 7, however, was a tropical fish retailer and gauged profitability as the percentage markup on each fish. Only tropical fish retailers reported that the cost of the fish was an impediment to its success.

Participant 7 provided a unique perspective on the Jurassic Park effect. For the previous interviews, the Jurassic Park effect was believed to inhibit the acceptance of genetically modified organisms. Participant 7, however, interpreted, "nature will find a way to survive," as a positive characteristic that allows for species survival despite mankind's mistakes. He was the only participant that believed the lack of human control over nature could have positive consequences. The other dimensions of the Jurassic Park effect, scientific hubris and trust did impact the participant.

During the analysis of interview 7, the regulatory and Jurassic Park families were merged. The Jurassic Park effect related to the participant's trust in the regulation of the technologies. Therefore, the regulatory theme was a component of the Jurassic Park effect instead of a unique family. The regulatory family addressed participants' trust in governmental agencies to effectively regulate biotechnologies. In previous interviews, it was believed that a participant's trust in regulatory agencies directly influenced the impact of the Jurassic Park effect. In interview 7, however, it was clear that it was trust in humanity, rather than trust in regulatory agencies, that was the predictor.

Interview 8: The Cost Conscience Laggard

Overview

Participant 8 was the owner and manager of a small aquarium store specializing in African cichlids. He had 20 years of industry experience and enjoyed his work, but did not dedicate considerable time to staying abreast of current industry trends. Participant 8 did not sell the fish for four reasons: cost, customer demand, drop in hype, and dislike of the technology. He took calls throughout the interview and his tone indicated that he was not interested in learning more about transgenic fish. When asked if he spoke with other retailers about transgenic fish, he responded, “I really haven’t gotten into that. I have too many other things to worry about.” He described his customer base as fairly advanced and attributed this to his specialization in cichlids. He told the interviewer, “Because I specialize in cichlids and a lot of people, I mean I have people from south Florida who make a trip up here every once in a while just because of the cichlids I carry.” Another differentiating characteristic was that he was the only participant to elaborate on the failing hype of the fish, and believed the GloFish™ was a fad that represented too much business risk for retailers. When asked if many customers asked for the fish he responded, “No. . . . That’s another one of the reasons too; you can add that on to the list. I think they’re more of a phase and they will dwindle. It’s kind of like the Tickle Me Elmo’s and everything else, they come up, they spike and then they fall off.”

The participant did not possess strong scientific acumen. When asked what the term transgenic meant to him, he responded, “honestly, it sounds something along the lines of a sex change, but I’ve never really thought about it.” He was not well informed about the biotechnology debate and had no impetus to perform an information search to become more educated on the issues. He decided not to stock the fish, and did not examine the issue further.

Product Attributes Family

After he reaffirmed the ranking of product attributes as color, price and then personality, little time was spent testing the limitations of the category. Color continued to rank as the primary buying attribute. In the tropical fish sector, price trumps personality. He remarked, “A lot of fish do have personalities, but a lot of people like the color.” Since he was a cichlids enthusiast, a question was asked about what attributes made them desirable. He described cichlids in the following way: “For one, they’re hardy, they’re extremely colorful, extremely active and there’s a large variety of them.” The description reaffirmed his previous descriptions of product attributes he felt were important.

Again he emphasized the importance of price and color when describing painted fish. He noted, “Everybody loves them because they’re very colorful and a lot of them are very reasonable.”

Economics Family

Cost was not only a sales attribute, but also a business risk associated with stocking the GloFish™. He mentioned that the economic risk was too great for the smaller retailer, “they tend to be a little expensive from a couple of the suppliers and it’s too much of a risk.” While he did not like the idea of a transgenic fish, the fact that he sold other enhanced fish that were less expensive indicated that he decided not to stock the fish was for economic reasons.

When asked what would make him want to sell the GloFish™, he stated that he “was not the greedy money-driven type. . . . I make ends meet and I’m happy with that.” And again, “Like I said, part of it has to do with the altering and cost, they tend to be expensive.”

Jurassic Park Effect Family

The Jurassic Park effect did not have an impact on participant 008’s decision to not stock the fish. Few codes constituting the category manifested during the interview. Participants with

strong confidence in the FDA regulation of the technologies also stated that we cannot truly be able to regulate nature. He stated, “Yeah, because I say to a lot of people, if they outgrow you, bring them back. Don’t release them; one, because you can get caught and get fined; two, because it’s so rampant in south Florida it’s ridiculous...” He believed that policing would be impossible. Getting people to stop releasing their fish into the wild was not really possible, the “unfortunate thing with that is it can’t be helped.”

Ethics Family

Participant 8 believed the only reason a retailer would stock the GloFish was for profits. Since he was a cichlid enthusiast, it is not surprising that he found the danio to be dull. He elaborated as to what type of retailer would stock the fish, “No, I mean, I really don’t have a lot of elaboration on that, to me that’s something that somebody is going to do to make money, that’s what they’d be in it for. I remember a lot of people carried it; a lot of the chains had it when it first came out.” When asked if he would ever consider selling the GloFish™, he responded, “No. A lot of those things are messing with Mother Nature.”

Ironically, this was the only participant to refuse to sell the GloFish™, but stocked the painted fish. The participant’s ethics were a paradox because he stocked a fish that had been harmed to produce a desirable attribute, but then did not stock the GloFish because it represented “messing with mother nature.” He continued, “No, I mean, I really don’t have a lot of elaboration on that, to me that’s something that somebody is going to do to make money, that’s what they’d be in it for.” He delineated between painted fish and genetically modified fish when he stated, “Well, like I said, it was a phase. And you’re messing with Mother Nature, you’re altering something. Granted the dying of the fish, you’re altering it, but you’re not going in and physically changing. You’re not messing with Mother Nature is what I am trying to say.” Describing the painted fish, he stated, “I keep them; I sell a couple here, and they’re the kids like

them. But the stuff wears off.” Given his lack of time allocated to researching issues, he contended that he would be unaware if the fish was harmed,” Even the injected fish wears off. I don’t know if it’s harming them or not.”

Regulation

Participant 8 was not well informed about which governmental agencies were tasked with governing transgenic fish. He decided not to stock the fish early in its introduction, and never re-examined the decision. Like participant 7, he claimed that the FDA should not spearhead the governance of transgenic ornamental fish. He stated,

Food and drug, it doesn’t sound like it. To me, it would seem like it’s more like the Wildlife Commission, actually something along those lines would be more appropriate, not food and drug. We’re not eating it or taking it as a pill, why would they be involved?

When the coordinated frame work was explained, however, he changed his opinion stating, “That makes sense if they have a little more experience with it. Maybe they need to partner with somebody or several people.” And again, “I guess if they have had the most experience, yeah. It doesn’t seem like they would be the ones, but if they have the most experience with it, from doing the plants, so that’s how they got their experience.” Ultimately the regulation of the technology does not impact his decision. He admitted, “I am sure they have strict guidelines, for safety and all that other, so I am sure it’s pretty safe.”

Comparative Analysis

During the analysis, careful consideration was given to the possibility of adding the economics category again. Economics was split between the ethics and product attributes categories after interview 4. This lumping, however, fails to capture the responses surrounding the business aspects of transgenic fish. While the business versus ethics code relates to both the ethics and economics families, a differentiation is necessary to explain such responses as, “Okay,

so one, the cost, and two, I don't do a lot of the tropical ornamental fish. I do keep a supply of them but I'm bigger into the saltwater and the cichlids, for a couple of varying reasons."

"Interesting. Like I said, I've just never really put a lot of thought into it. It's kind of one of those things, you make a decision and run with it."

Interview 09: The Pragmatic Retailer

Overview

Participant 9 was the owner and manager of a small retail store in Jacksonville selling both marine and freshwater fish. He was informed about how, why, and when the GloFish™ was created and had a cursory understanding of the governmental agencies responsible for the oversight of transgenic organisms. The GloFish™ had been a topic of conversation with his colleagues when it was first released; but as the hype decreased, it became another product offering. Unlike participant 8, participant 9 understood that he needed to sell fish to make money. While he was a biotechnology proponent and a fan of the GloFish™, he had difficulty making the fish profitable. He was willing to give customers what they wanted, but did not compromise his morals. He admitted that there would be limitations to what he would be willing to sell and inferred that creating esthetically pleasing colored fish was not adequate social utility from genetic engineering.

The product attributes category was strengthened, and a new dimension on personality manifested in the interview, desirable carnivorous aggression. Codes constituting the ethics category appeared frequently in the interview, and the Jurassic Park effect provided a minimal contribution to the retailers' perception of the GloFish™. The small contribution of the effect could be attributed to faith in humanity and governmental oversight of transgenic organisms. The resurrected economics category also appeared in the interview in the context of business operations.

Product Attributes Category

The product attributes of color, personality, survivability, and price were mentioned by the participant. When asked what characteristics make a fish sell, he responded,

The vast majority of people, the other 80% are buying fish because they like the way they look. Oscars, in a nice, clean tank, are pretty fish. They've got a lot of personality. Like I said, those people are looking for something that is easy to keep, hardy; hardy is the big thing for a lot of folks.

Unlike other participants, he mentioned aggressive behavior as a favorable characteristic that made many fish, like Oscars, more valuable. He noted that people enjoyed watching fish eat other fish, and he sold thousands of feeders a month. He was critical, however, of many customers who feed their fish feeders when it was not in the fish's best interest in terms of health. He commented, "There are people who buy African cichlids, which are 100% herbivores in the wild, that feed them almost nothing but feeders." He was the only participant to mention that carnivorous fish were more valuable because the owner could watch them eat other fish. Therefore, while the GloFish™ was colorful, it lacked a desirable personality. Participant 9 was critical of customers who do not adequately care for their aquarium fish. "When they say 'is this fish hardy,' they mean if I neglect it, will it stay alive."

Also, like participant 7, he insinuated that the fact the fish were genetically engineered was a sales attribute. When he was asked if the fact that they were genetically modified sold more fish he responded, "A few. Most of the fish were sold by us, not really people coming in looking for them. It was a thing like, oh yeah, I heard about that, and oh yeah, they're really cool, okay I'll get one. The vast majority were sold, they weren't bought."

The cost of the fish was a significant impetus of fewer sales. Participant 9 did not believe the GloFish™ provided added value; he did not believe that people were getting a great deal of

value from buying the fish. He admitted that while he stocked them, he did not have any in his current inventory. When asked if he sold them and if cost was an issue, he responded,

Yeah, we sell it. I don't have any in here right now, but they're \$5.00. They're not a thing where people are, oh gosh, I can't afford that. But they look best when you get a whole group of them. We haven't done, and I don't know that all that many people have done that well with them. Seagrest and 5-D tell me they're not moving a whole lot of them. Even when they first came out we weren't moving a lot of them.

The sales of the fish were lower than expected as a result of two factors: the proximity of a cheaper substitute, the nongenetically modified danio, and the relative high cost of the fish. He elaborated, "It's a five dollar danio. It's a fish you can normally buy for 99 cents, and it doesn't look that much different." While five dollars was not too expensive for a fish. He believed the GloFish was overpriced, and noted "I don't think people are seeing the value of it." Again when asked for clarification as to whether the price justified the coloration, he responded, "No, not five times as much, because danios look best in groups, groups of 10 to 12, and the people that are looking at them aren't going to spend \$50 or \$60 just to get a little group of fish that are red."

Finally, a hypothetical question about pricing was asked to determine if the participant believed whether more intense coloration or lower price was the reason for sluggish sales. When he was asked if he would have been able to sell more fish at a lower price, he answered, "Possibly, if they could sell for \$2, I am sure they would probably sell quite a bit better."

Color continued to be the primary sales attribute; however, there was a valuation placed on the intensity of the color. Since the coloration was not intense enough in the GloFish™ to differentiate it from the nonengineered danio, the sales of the fish had been hurt. Further, due to the small size of the fish, several fish had to be purchased to get the total effect of the coloration making the cost of the fish greater than other larger species.

Economics Family

The new economics family was captured in extensive dialog addressing the cost of the fish. Participant 9 viewed the GloFish™ as a function of profitability. The ultimate decision to stock the fish was based on perceived marketability. When asked why some retailers stock the fish while others do not, he answered, “The reason I think is that some people will carry this type of fish and some people won’t is some people are hobbyists and got into the business as a hobby and will probably be out of the business as a hobbyist and some people are in it as a business.” Like participant 8, he divided retailers into two groups: those who are in it for a business and those who do it for a hobby. While participant 8 perceived himself as a hobbyist rather than a businessman, Participant 9 understood that he was running a business and needed to pay his bills.

Jurassic Park Effect

The Jurassic Park effect contributed minimally to the participant’s perception of the GloFish™. Since either faith in humanity or governmental regulation mitigates the Jurassic Park effect, he never mentioned that a cataclysmic event would result from genetic engineering. As well, he did not have any fear of the unknown consequence of scientific advancement. He did admit, however, that aquarium fish are able to adapt to their environments. “We’ve gone out to do tanks where you can’t even see three inches in the tank; the fish somehow adapted.” Like interviewee 7, he viewed the will of a species to survive as a positive rather than a negative.

While he implied that genetic engineering was dangerous and scientific advancements were not necessarily safe, he believed the government oversight would prohibit natural abominations. His faith in the governmental entities tasked with regulating biotechnology influenced the prevalence of the Jurassic Park effect and also impacted the ethics category. While he mentioned the release of aquarium fish into the environment by owners, he did not appear bothered by the implication of releasing genetically modified aquarium fish.

The small role of the Jurassic Park effect in influencing the participant's opinion of the GloFish™ can also be explained by the physical attributes of the fish. Given that the fish was an inch long herbivore, and “relatively innocuous,” he did not have any fear of the unknown consequences of developing the fish.

Ethics Family

Considerable dialog was given to the ethical implications of transgenic fish and the broader aquarium sector. The “Playing God” code did not appear in the interview, but the participant did define boundaries about what was acceptable to produce through genetic engineering. While he did not have reservations about experimenting on higher vertebrates, he did have concerns about the purpose and outcomes of the research.

The ethical quagmire of the painted fish was discussed in the interview. While, he did not like the painted fish, he was willing to sell it. Participant 9 did not have an ethical problem selling either the GloFish™ or the painted fish. When asked about his overall impression with genetic engineering he began discussing the painted fish. He elaborated,

I think it's a very good thing. I think it's an extension of what we are. To not do it would be, I think foolish, because there are so many good things that come from that. The fish that are altered that I don't like are not genetically altered; they are dyed and things like that. There are some fish with dye injected into it. I saw a parrot fish yesterday, they called it a lipstick parrot, where they injected dye into the lips of the fish and injected a checker board pattern on the side of the fish, and it might not hurt the fish at all, but to me it just looked...I didn't like it whatsoever.

He described the painted fish as something he did not approve of, while he was strongly supportive of technologies used to enhance coloration without harming the fish.

When you have a Dachshund or a Poodle, you've got something that has been genetically engineered and altered, it is not natural, so to say that you don't want a specific type of fish for that reason, people are probably hypocrites. Like I said, more than likely they have something that has been genetically altered; we are genetically altered like that. We select what we breed. I have a problem with it if you are going to take something that doesn't have any natural enemies and it can be released in the wild, and normally like that, it's not

necessarily the fish's fault. People are taking it and putting it in an area where it shouldn't be, but most of the time that's naturally occurring fish like snake heads, things like that.

There was also dialog about customer responsibility for ensuring the health of their pets. According to the participant, people will feed fish the wrong diet for amusement. "In the wild maybe 15% of their diet is fish, but there's people that buy them that feed them nothing but goldfish and they end up with a filthy tank with fish that are obese, it cuts down on the life span." Again he described how customers would purchase a fish just to watch it consume feeder fish. He explained, "There are people who buy African cichlids, which are 100% herbivores in the wild, that feed them almost nothing but feeders. That really annoys me too because it cuts down on the life span of the fish." Ultimately, he believed that customers did not care about the welfare of the fish. He noted that people would ask him what fish required the least amount of work, and he assumed they were asking for something that they could neglect.

The biotechnology cut off point was established when he asked what attributes he would not buy if they were the result of genetic enhancement. He answered,

If it looked freakish to the point where you are like, that really shouldn't exist, it was developed just for a side show, like a bodyless head that you can just add, and literally I am sure they could do that. But like I said, if they just did something just for freak value; like I said, the glow fish was engineered for a purpose and then they took the technology from that and said okay, we can make ones that stay red and ones that stay green.

Like participant 6, he believed there needed to be a social benefit to genetic engineering since there was an inherent risk associated with the innovation. The risk perception manifested when he drew a parallel with genetic engineering and the manufacturing of dynamite. He said, "Lots of really good things come from things that are dangerous." Due to the small size of the fish, he admitted that it did not seem threatening.

Regulation

The participant knew that the FDA was responsible for GloFish™ regulation, and had a cursory understanding of the coordinated framework used to regulate transgenic organisms. He had significant faith in governmental regulation of transgenic organisms. He viewed the FDA's role as expanding beyond basic oversight to also prohibit the development of either dangerous or morally reprehensible organisms. When he was asked if he liked the fact that there was oversight in place, he responded,

Yeah, I think it's good. There are certain things where I don't think they should do unlimited research, just like human cloning; because you can take and come up with something that really shouldn't be there. It is not going to take and assimilate well and I am sure you could do the same thing, you can come up with an animal that won't be eaten by other things because of the way it tastes and then they are running rampant and maybe eat all the vegetation. So it's not necessarily something that is going to eat all the fish, it might affect the food chain in another way. So yeah, it shouldn't be something that is completely unlimited.

Participant 8 did not lack faith in humanity. He believed the FDA was the appropriate agency to govern the GloFish™ and that regulatory oversight would police the scientific community. He did not believe that governmental oversight was always effective. He explained how poorly regulated the harvesting of live corals had become.

Comparative Analysis

Participant 9 shared the most commonalities with the pilot study participant. They were early adopters, disliked the painted fish, were well informed about the biotechnology debate, and both had similar customer bases. Both interviews had similar responses to the structured interview questions, with the primary differences attributed to the decrease in media attention and hype of transgenic ornamental fish.

Like the first participant, 9 stocked the fish months before it was officially released. The reason for stocking the fish was economic; he believed he would make more money. While two

years of time have elapsed between the first and ninth interview, the initial hype surrounding the release of the GloFish™ to the public manifested in the interview. It was inferred from the interview, however, that the hype over the GloFish™ had begun to grow dull based on the pattern of responses, and references to the fish's lackluster sales.

Secondly, participant 9, like the first participant, also disliked the painted fish. He felt that the fish was not only harmed during the tattooing procedure, but also felt that the attribute of survivability was compromised. He drew parallels among the GloFish™, painted fish, and corals. For the participant, the GloFish™ was a superior product since its “unnatural” alteration did not impact the fish's health. He mentioned that animal breeders have been doing the same thing for hundreds of years and felt that it was important to utilize the technologies to displace practices such as the production of painted fish. Still, unlike the first participant who was unwilling to sell them, the ninth participant did stock painted fish.

Thirdly, he was well informed about the biotechnology debate and had dialoged with other retailers about the GloFish™ when it was first released. The participant was pro-biotechnology and exhibited a high degree of trust in humanity and the FDA's ability to govern the technologies. While he did not explicitly describe invasive species, he did reference environmental degradation resulting from the release of aquarium fish.

Fourthly, the first and ninth stores had similar products and similar customer bases. Both stores sold marine and tropical fish and had a moderately advanced hobbyist clientele. According to participant 9, only about 15% of his customer base was advanced, with about 85% just trying to keep the fish alive. Finally, like participant 1, he mentioned that his location might have an impact on the sale of GloFish™, which he described as slow. He noted, “Yeah, I am sure there are other parts of the country where they sold much better.”

Customer demographics heavily impacted the retailers' perception. If the demand was there, then the fish would most likely be stocked. The ninth participant's perception of demand had changed over the 2 years however. While there were initial brochures and marketing materials for the GloFish™, the materials were no longer available, making its differentiation from nontransgenic danios based on coloration only. He admitted that he did not recognize much of a difference between the \$5 fish and its \$.99 relative.

Interview 10: The Ethics Policeman

Overview

Participant 10 did not sell the GloFish™ and was a skeptic about biotechnology. While he did not fully reject genetic engineering, the social benefits were heavily considered. The participant did not believe altering a fish for esthetics was ethical, but would have considered selling a fish that had been genetically altered to be more disease resistant. His decision to not stock the GloFish™ resulted from the combination of lack of profitability and perceived value. He specifically opposed the reason why the GloFish™ was marketed, esthetics, rather than the technology used to create it.

He first learned that the GloFish™ was available while reading trade journals and apparently was influenced by mass media based on his references to human cloning and stem cell research. While he originally sold both fresh and marine fish, he had made a business decision to phase out his fresh water offerings. The store catered to more advanced marine hobbyists who were less cost conscious and more interested in the health and welfare of the fish. Participant 10 was the only subject to acknowledge the internet's role in promoting certain fish species, and made references to the importance of hype and mass media in promoting the sales of certain species.

The participant described the level of knowledge his average consumer had about aquarium fish as “Basic at best.” He viewed his role as store owner as an ambassador for the aquarium industry. His experience made him arrogant, and he had disdain for novice hobbyists who were influenced by the color and price of fish. The participant believed he needed to police his customers to ensure they purchased ethically produced pets.

Considerable dialog fell into the ethics and product attributes category. For participant 10, the product attributes caused the ethical quagmires in the aquarium industry. Consumers wanted esthetically pleasing fish, which created a market for species not well suited to the aquarium industry. He implied that the over-arching attribute of coloration facilitated the production of the GloFish™. In the interview, ethics and product attributes were closely interwoven, but, ultimately, ethics and profitability most heavily impacted his reaction to the GloFish™.

Product Attributes Category

The product attributes category appeared throughout the interview. Coloration, survivability, and personality were the most important attributes for the customers. Like other strictly marine stores, cost seldom factored into a customer’s buying decision. The category was explored in detail to ascertain why the participant did not find the GloFish™ marketable. Questions were asked about how he made stocking decisions and why he had moved to a total marine format.

Participant 10 viewed his role not only as the store manager, but also as a representative of the hobby. He believed that he was privy to knowledge that his customer base did not have and that he was responsible for ethically policing what was sold in his store. When asked how he decided what to stock in the store he answered,

Most of the time, whatever interests me is what I stock, a very self-centered thing; there are some things I just outright refuse to because of survivability or that they are not collected

ethically. I do factor in customer wants, but there are things I just will not bring in because I don't agree with it or don't like it.

His dual role of catering to the customer while ethically policing their buying decisions places his responses in both the consumer attribute and ethics categories. He willingly meets customers' demands until they push him beyond his ethical boundary delineated by selling fish that either was "not collected ethically" or that he does not "like."

He "factors in" customer wants, but does not simply select fish based on perceived marketability. (Again, his perceived role as an aquarium hobby representative was evident when he described the responsibility of aquarium retailers of educating the consumer and ensuring the fish's welfare. He felt he was ethically responsible for giving the fish a chance at survival, "because we're pulling it out of the wild, for our enjoyment . . . we have the responsibility to at least give it a half-way decent shot at a normal life and its normal life span.")

In addition to his role as a benevolent representative, he viewed customers who differed from his conceptualization of product attributes as inferior. He was an aquarium hobby elitist. This viewpoint manifested when a specific question was asked about the importance of coloration. He admitted that, while color was not a primary attribute for him, it was what most of his customers wanted. He elaborated, "For my consumers, most of it is; a lot of it has to do with what is showy, flashy and bright and that would be the bulk of the customers." He mentioned, however, that his savvy "educated" customers were less interested in color, and more interested in personality and survivability attributes. Ultimately, while the bulk of his customers desired coloration, his more advanced customers examined a variety of factors when purchasing a fish.

While he believed that hype increased sales, color, personality, survivability and price were the greatest contributing factors. He ranked their importance as follows, "coloration first,

survivability next, and then personality and costs. I try to cater more to actual hobbyists; my client base is a little skewed sometimes. I know for a lot of people, cost is number one; it's always about cost."

The participant did not perceive added value in modifying a fish's natural coloration. He noted, "To me, that doesn't have any beauty; the painted fish or the day-glow fish, they just don't have any appeal to me. I would rather see a zebra danio in its natural state; I think it's a nice looking fish. Most people don't, but I do."

Economics Family

While the participant believed that selling either painted fish or the GloFish™ was immoral, he did understand that his survival in the business world was a function of profitability. Participant 10's decision to discontinue selling tropical fish exemplifies his clear understanding of sound business practices. While he perceived himself as an enthusiast, he also wanted to provide the highest quality product at the best price.

It was inferred from the interview that he neither agreed with using biotechnology to create aquarium fish with enhanced coloration, nor did he believe that they would be a profitable product for the industry. The perceived profitability of the fish may have outweighed his general dislike of the fish, but the weighting of the factors could not be determined from the transcripts. It can be inferred, however, from his admission that he would sell genetically modified fish with enhanced survivability characteristics, that survivability was the most influential attribute.

Another economic factor influencing the participant's perception of the GloFish™ is the type of consumer it attracts. He implied that people who wanted intense coloration were novices in the aquarium hobby and were ultimately less willing to pay more for healthy fish (Paragraph 028). He noted, "There is a segment within the marine hobby that is nothing but cost and those are also the ones that I referenced with their knowledge base being deficient and being resistant

to learning.” Ultimately, his key customers would not purchase the GloFish™, and selling the GloFish™ would attract cost sensitive novices. While the participant may have professed to have an ethical dilemma regarding stocking the GloFish™, based on his responses, he appeared to be heavily influenced by profitability.

The Jurassic Park Effect

Participant 10 was not heavily influenced by the Jurassic Park effect. There was, however, one response that indicated that he had a modicum of concern about potential unknown consequences. When he was asked if genetic engineering was either safe or dangerous, he explained,

I think we might get some unforeseen problems arise because I don't think we are perfectly capable of predicting everything that we do. From what little I do know, most of those genes control multiple things, you turn on off or on, sometimes there will be combinations that we did not foresee.

The concern was mitigated, however, by his belief that humanity would be able to solve the mistakes stemming from genetic engineering. Ultimately, the Jurassic Park effect manifested in the interview, but it had minimal impact on the participant's reaction toward the GloFish™.

Invasive species were discussed, but not in the context of a reason to not stock transgenic fish. The release of the GloFish™ into unnatural environments did not have more environmental repercussions than releasing any other nonindigenous species. He believed invasive species would empower special interest groups to destroy the industry. In effect, he accepted that invasive species were a byproduct of the hobby. When he was asked about his perspective on invasive species, he commented,

I think it's going to be the doom of the industry eventually. I understand there are times when things are out of our control, like a natural disaster and somehow some animals get released in the wild, but I do see a lot of irresponsibility with people who have the wrong tanks and the fish get too big. They just throw them in a lake or some waterway. I think the environmental groups will eventually get their way and restrict all exotics.

Ethics Category

There was considerable overlap between the ethics and product attributes categories. Participant 10 viewed the drive to fill the consumer's demands to be the cause of the ethical dilemma inherent in the aquarium industry. Clear ethical boundaries were delineated throughout the interview. While he was a biotechnology skeptic, he admitted that he would purchase and sell transgenic fish with enhanced survivability. The roll of ethics in crystallizing his opinions towards stocking the GloFish™ were apparent when he described his perception of genetic engineering: "I am for it, but sometimes the ethics concern me; where it might possibly lead us. I am for it, but I am weary that it might be taken too far."

Participant 010 had clearly defined ethical boundaries delineated by the reasons for genetically modifying the fish. His perspective, that the social benefit had to justify the genetic alternation, manifested when he noted when he would be a proponent of a genetic alteration. The participant explained,

It depends how they are modified and what was the intent of modifying; if it's for disease resistance I would be more inclined to purchase that. If they were modified just to change the color from what I have to a red-flame angel to a neon purple-flame angel, I would not be inclined to purchase those types of fish.

As noted in the product attributes category, coloration, while desirable to many of his customers, did not enhance his perceived value of the fish. Therefore, the GloFish™ is ethically unacceptable to him since changing the coloration is neither a justifiable alteration nor does it enhance the intrinsic value of the fish. The participant clarified his position against the GloFish™,

I am more in it for the natural aspect of the animal, to appreciate the animal for what it is, not to make it more appealing to human sensibilities. It equates with I would rather go see an elephant in a natural preserve than seeing them in a circus. I would rather see a more natural representation of it rather than something that's been modified to make it more pleasing to humans, that is the best I can put it.

While he does not want the fish modified for aesthetic reasons, he was willing to sell genetically modified fish that looked the same as their non-GM relatives, but had enhanced survivability attributes like salt water fish surviving in fresh water environments. When asked if he believed the technology would help the industry, he responded, “I hope so; I would really like to see the survivability aspect addressed if we could.” He elaborated, as well, on the justifiable reasons for genetically modifying a fish. He told the interviewer, “If you were just doing it for cosmetic reasons, to me I don’t find any use or appeal. If it’s making something more survivable, yeah, I think that would be a good thing.”

There was considerable dialog about the ethics of the broader aquarium trade. He described one of his suppliers as using “cyanide” to “rape an entire environment” and told the moderator that he was frequently placed in moral dilemmas by his suppliers and customers. He admitted,

Occasionally we do get some things in that I feel are inappropriate and should not be collected. We do our best to care for them and if we are going to move them on to somebody else we try to make sure that the person who is getting them is fully aware of the difficulty associated with it, the likelihood that it is not going to survive and then we usually just recoup our costs out of it and move it on to somebody who will hopefully be able to maintain it for however long they can.

His response also reflects his role as a representative of the aquarium industry. While he sold the fish that would most likely not survive, providing a caveat to the consumer and making a best effort to ensure the fish’s welfare mitigated the ethical implications of the transaction. The heavy influence upon the ethics category is apparent in the interview exemplified by the amount of time the participant allocated to discussing it.

Regulation

While he was not familiar with the governmental agencies tasked with regulation, he did mention that oversight was necessary because the “private sector would run amuck if allowed.”

When the regulation questions were asked, the influence of governmental oversight did not appear to heavily influence this retailer's response toward the transgenic fish. The participant claimed to be a Libertarian, believing in limited government, but felt that oversight was necessary to keep the private sector regulated. He said, "I don't necessarily trust them with my libertarian core beliefs; I don't trust industry to govern themselves so I guess the FDA would be as good a government agency as any if it has to be the government." While he believed that some regulation was necessary, he did not feel placated by the presence of a governmental entity providing oversight.

Comparative Analysis

Interview 10 did not push the limits of the categories, but reaffirmed that ethics and economics drives the stocking decision. The Jurassic Park effect, while creating skeptics, is not powerful enough to cause a retailer to refuse to stock the fish. In interview 10, like interviews 2, 4, 5, 7, and 8 the order of product attribute importance was color, price, and personality. The participant, however, was not as eager to sell a genetically modified fish even if it could be profitable. If survivability could be enhanced and he could make a profit then he would reluctantly sell it. The ethics category was the most influential in driving the participant's decision to not stock the fish, but economics was a close second. Participant 10 had a great deal in common with participant 3, who was driven by ethics rooted in a religious paradigm.

The product attributes category remained relatively unchanged in interview 10. The influence of the product attributes category in stocking decisions has become more questionable, since the only people who have the ability, but refuse to stock the fish, have done so because of economic or ethical reasons. If the most dominant attribute of the GloFish™ is its color, and the primary product attribute consumers want is color, the GloFish™ should be stocked in every store. Since the interviews do no support this deductive reasoning, the category presents a

paradox. None the less, the product attributes category explains a portion of the retailers' response to transgenic fish. As well, the product attributes category reveals the elements in fish that retailers believe make them desirable to consumers. If the GloFish™ did not have any product attributes that the retailers found desirable, their reaction would have been different. The GloFish™, however, provides retailers with the option to stock a highly colorful fish, that unlike the painted fish, is healthy and unharmed.

For all other participants, the Jurassic Park effect influenced the retailer's perception of the GloFish™, but the extent of the influence was predictable. The Jurassic Park effect category had a slight effect on participant 10. Other participants who were minimally influenced by the effect include 1, 2, 7, and 9. The strength of the effect is related to participants' trust and perceived consequences. Fear is the outcome of the effect that can be mitigated by high trust and low perceived consequences

Participant 10, while being driven by ethics in his decision to not stock the fish, also believed the margins were not adequate. His personal beliefs were also reinforced by his perception that the GloFish™ was neither a good business decision nor was a likely product to attract desirable clientele. Ethics were the primary motivations driving the participant's perception of the GloFish™, but economics were also heavily considered. Like participant 2, and 5, participant 10 had concerns that the smaller retailer stores would be able to stock the fish.

Interview 10 provided the researcher with an instance where economics and ethics influenced the stocking decision. He did not stock the fish, and the Jurassic Park effect played a minimal role in that decision. Participant 10 further demonstrated its low significance in influencing retailer's stocking decisions.

Interview 11: The Rational GloFish™ Supporter

Overview

Participant 11 was the manager of a pet shop in Tampa that sold both marine and freshwater species. While she was not the owner of the shop, she had considerable influence in the buying decisions, and, initially, refused to stock GloFish™. She successfully lobbied the owner to delay stocking GloFish™ because of suspicions that the transgenic fish, like the painted fish, was harmed during its creation. Her aversion towards creating a fish with intense coloration transcended painted and glass fish to include the GloFish™. Upon further consideration, however, the participant supported the store's decision to stock the fish. She made a rational decision to stock the fish, but was heavily biased by the painted fish. Considerable effort was made to understand what information facilitated her change of heart.

Participant 11's research focused on the health and of the fish rather than the environmental ramifications resulting from releasing genetically modified organisms into the environment. After researching information on the GloFish™, she realized that the fish's health was not compromised. Ultimately, the GloFish™ was stocked for economic reasons as well as offering the customers an alternative to the painted fish that they refused to stock.

Product Attributes Category

Participant 11 made stocking decisions based on customers' buying trends. When asked what customers looked for in a fish, she responded, "Size and color, they want the big colorful stuff, active stuff." Cost, however, played a significant role in her customers' buying decisions. Clarification was asked about the order of importance, and she responded, "Cost is always number one with our customers. It always overweighs color. They look at color first and then the next thing out of their mouth is how much is it going to cost. Cost, color, size, survivability, and then personality." In effect, the coloration initiates the buying decision, and based on her

ranking is the premium attribute. It was inferred from the interview that few customers were concerned about survivability, and most entrusted her to make correct recommendations about which fish to buy.

She was asked to describe the decision-making process to stock fish, and she focused on her role of matching the fish's needs with a customer's ability to meet them.

What customers ask for, specific things, and then either me or the other manager will do a little background research on it and see what kind of fish it grows to be, if it a good suit for what someone asks for. Like the South American red-tail cats; there is a tank-raised one out there right now and that's the only one because a customer requested it for a pond at his big house, and that's the only reason I got it. So if somebody asks for oddball stuff we background research it and make sure you are going to take care of it; we're not going to just buy a fish that you will end up killing in the long run.

Coloration continues to be the primary attribute that drives the perceived value of a fish, however, cost factors into the final buying decision. Participant 11's efforts to acquire special order fish revealed that customers demand unique products that they could not find at competing stores. The "uniqueness" product attribute drove some customers to specifically request the GloFish™ because it was genetically modified. She noted, "Some asked if we were going to have them; some asked why we were going to have them. It's more people requesting them, so we decided okay, we'll get a couple and see how it goes because right off the bat we weren't that wild about it."

The GloFish™ was stocked as an alternative to the painted fish. It provided customers with the color product attribute without compromising survivability. While the hierarchy of color, price, and personality remained unchanged in interview 11, the relationship between color and price became more clear. Customers initially look for color, and then, if the price is right, they purchase the fish.

Economics

In interview 11 there was considerable overlap between the economics and ethics categories. The participant always placed ethics before economic profit, but she understood that she was being paid to make money for the store's owner. Her aversion of painted fish and her refusal to stock them, despite economic incentive demonstrates her priorities.

Customer demand drove stocking decisions. When she was asked why the store made the decision to stock the GloFish™, she answered, "Basically customers asked for the product." Economics was the impetus for the adoption of the GloFish™, but only after the ethical questions had been answered through an exhaustive research process. She was asked if she investigated the fish before stocking it. "Yeah, we did. We made sure of why they did it; why they decided to make a pink fish." As exemplified by the painted fish, she refused to profit from an organism that had been created through unethical means. "Well, we don't like to carry the injected glass fish; we won't carry those at all. The dyed fish, we won't carry those at all." Once they verified that the fish was neither harmed nor survivability compromised, the decision was made to purchase GloFish™. "We always put up fits when he tried to bring in a dyed fish or something like that, so we said, no you've got to wait, we've got to figure it out first."

The participant believed that genetic modification had to be justified, and that profits were never an adequate justification. She was asked about her impression of genetic engineering and she elaborated,

It depends on what it's for, what it's accomplishing. There's a lot of stuff that I agree with everyone else that it shouldn't be messed with, but it depends on what your outcome is trying to do. I will sell the glow fish, but their originality wasn't intended to be what it turned into anyway and we carry it, but if you're talking altering something just to mass produce it to make money off it, no.

She had a Machiavellian perspective on genetic engineering. To participant 11, genetic engineering must have social benefits. The reasons for genetically modifying organisms can be justified, “it just depends on what you’re doing it for.”

For participant 11, economic profits did not justify genetic modification. “Why genetically alter something unless it’s going to make some huge benefit . . . other than just money.” She realized, however, that economic incentive was a necessary impetus. “If it’s genetically altered to benefit your life, you’re not commercializing . . . something, but you can’t have one without the other.” She noted again that genetic engineering was acceptable for health benefits but not profits, “but you can’t have one without the other.”

Jurassic Park Effect

The participant neither feared the unknown consequences of creating transgenic fish nor distrusted humanity, and, therefore, the impact of the Jurassic Park effect was minimal. She was in the low consequence high trust quadrant, yet the Jurassic Park effect was present. When she was asked if there was anything that made her question the safety of the GloFish™ she answered, “As far as safety as in possible release? Not, really; there is always the possibility that you don’t know of, but just going from customer to customer, no.” Despite a large amount of trust, she remained uncertain about possible unknown consequences to genetically modifying organisms.

While she had ethical concerns about the reasons for genetic engineering, she was comfortable with selling the fish. She was asked to elaborate on the paradox and explained that she did not perceive a risk. “It’s a dano; it’s not a harmful, big invasive fish. They’re more likely to be a meal if anything, so while it can live in our waters . . . anything can be an invasive species.” She was asked if the size of the fish made her comfortable and she answered “yes.”

The participant did realize that governance was difficult and that keeping track of the fish would be difficult. She admitted that while they gave store credit to customers who brought their fish back, others would release them into waterways. “Mainly our customers are freshwater fish so we don’t have to worry about stuff like that, but we make a point to tell them if they have a fish and they have to get rid of it, to bring it to us and we will take care of it, just don’t let it go. Short of that, it’s really hard to keep track of.” The perceived consequences of the releasing the GloFish™ into nature were low, so the Jurassic Park effect had a minimal impact on participant 11.

As well, the participant had a high degree of trust. She trusted governmental agencies to properly regulate transgenic fish. The participant made the assumption that if the GloFish™ was available to the public under governmental oversight, then it was safe. “We didn’t really look at the agencies in charge; we look more at the aspect of the safety to the fish, not the environmental side of it. We try to with most things, but that’s when it falls down to the customers.” She bounded her research by assuming that government would perform its appropriate function.

While it was not clearly stated, it was implied that the participant placed a great deal of regulatory responsibility in the hands of retailers and customers. She assumed that other stores would make rational decision on what should or should not be stocked in the stores. She believed it was the retailers’ responsibility to protect customers, even from the own actions as exemplified by refusing to sell a high venomous blue ringed octopus. The question was asked if she was forced to sell a fish that she was not comfortable selling and she answered, “Not really. We’ve had customers ask for some far-fetched things like an octopus and we were like no way.”

Ethics Category

Participant 11 initially refused to stock the GloFish™ because she believed it was harmed in its creation like the painted fish. For ethical reasons, she blocked all painted and all dyed fish from entering the store regardless of the profits that could be made. She noted,

The manager before wanted to get them just because it would sell and we were like, no, we don't want you to buy this. We always put up fits when he tried to bring in a dyed fish or something like that, so we said, no you've got to wait, we've got to figure it out first.

The ethics of creating the painted fish were transferred to the GloFish™. When she was asked to why she was not eager to stock the fish when it was first offered, she responded,

Well, we don't like to carry the injected glass fish; we won't carry those at all. The dyed fish, we won't carry those at all. Why that turned into an exception, it's kind of hard to explain; it was kind of a store decision on part of all the employees. We have a good say in why we do or don't carry some things. Those, it was more because it was a genetic change, therefore you are not harming the fish, you are not injecting the fish. You are not harming the health of the fish.

The reasons for genetically modifying an organism were important to the participant.

When she was asked about her first impression of the GloFish™, she responded, "It kind of fell down the line of everybody saying, 'Why did they do that?' There has to be a point but I don't see it. It makes a pretty fish, but what do you need a pretty fish for?" She vehemently opposed selling the painted fish. "The injected fish, the dyed fish . . . that are injected with smiley faces on the side, definitely not, I am not going to condone that."

Her desire to learn and share information with customers transcended the GloFish™ to include all the fish that she stocked. The question was asked, "Are there species that you would not stock?" She responded,

The hard-to-take-care-of stuff, that generally shouldn't be taken from the wild because it's not a good suit to be in a home aquarium. There's no really suitable sized aquarium to take care of it properly or just the general public not knowing how to take of it properly. There is no point in it being taken from the wild if it's not going to live.

Participant 11 viewed her role as an information provider who could link the demands of the customer with the demands of a fish. While color, cost, and personality were important, she viewed her role as a salesperson to meet both the desires of the customer, and the needs of their pets. Therefore, her ethics were centered on the health and well being of customer's pets rather than possible environmental degradation.

Participant 11's perception of biotechnology was unclear. While she was originally opposed to the GloFish™, it was never because she opposed genetic engineering. Participant 11 had clearly defined ethical boundaries that she reinforced through research. She informed the interviewer that she was opposed to genetically modified organisms, but at the same time, realized her hypocrisy of selling the GloFish™.

Comparative Analysis

Interview 11 was dominated by ethics and health discussion. Once again, the economic category remained secondary to ethics. Participants 1, and 2 had the most in common with participant 11. All three allocated time to researching the GloFish™ before a stocking decision was made. As well, fish health and profitability, rather than environmental degradation, was the primary stocking impetus. The pilot participant and participant 11 both considered the painted fish to be deplorable, but the pilot participant was still willing to stock it. Participant 11 possessed a strong aversion to the ethics driving the creation of the painted fish in the same way that Participant 4's religious convictions would prohibit him from selling it.

During the comparative analysis following interview 10, the importance of the product attributes category came into question since the category was poorly defined. Product attributes and profitability are related; the perceived value of the fish is captured by its product attributes. The greater the alignment of the product attributes with customers' desires, the more fish are sold and the greater the profitability. Therefore, a highly colorful fish that is well priced should be in

high demand and be lucrative for the retailer. Since economic profitability drives the stocking decision and economic profitability results from product attributes, product attributes do drive the stocking decisions.

The strong correlation between color and price occurs both in marine and tropical fish markets; the more colorful the fish the more the fish costs. The ceiling for costs, however, remains much lower in the tropical fish market. While marine hobbyists are willing to pay a premium for intense coloration, they also must factor in the potential for survival due to the increased value of their product (Figure 4-2). Qualitative methods do not allow for quantitative description of the relationship, but future research could further elucidate the trend.

Other interviews indicated that size of product selection was important to the customer. The pilot participant viewed the GloFish™ as a chance to differentiate himself from large retail chains that had moved into the aquarium retail sector. Interview 4 and interview 10 also indicated that the GloFish™ was stocked to offer customers variety. While selection was instrumental in drawing customers in the store, it was a retailer attribute rather than a product attribute and therefore is outside the scope of inquiry.

This interview continues to support the Jurassic Park effect where risk perception and trust heavily influence a person's fear of the unknown. Participant 11 was minimally impacted by the effect due to her lack of fear in the unknown and a basic trust in humanity. The fish's small size and herbivorous nature made it appear benign. To her the GloFish™ did not appear menacing and therefore the environmental risks were minimal. The participant's original rejection was not attributed to the Jurassic Park effect. The effect did not have a deleterious consequence to the decision to stock the fish.

Her ethical policing was very similar to participant 10 who also believed that retailers were empowered to ensure that only ethical and healthy fish were sold to the public. The customer policing characteristic directly impacts the buying decision since it prohibits stocking fish that are either dangerous or unhealthy. Policing, however, has always been in the context of fish health instead of potential environmental degradation. There has not been a participant who polices the potential for invasive species. Participant 11's concern for the health of the fish and the ethical implication of creating an aesthetically pleasing organism were of much greater concern to her than potential environmental destruction.

The ethics category contains a paradoxical pattern of responses where the participant realizes the necessity of profit, but also has strong ethical concerns over the creation and collection of aquarium fish. Participant 11 exemplified the ethics paradox. While she must maximize profits as a store manager, she must balance the profitability of the store with ethical boundaries such as her refusal to sell painted fish.

Interview 12

Overview

Interview 12 was performed at the front desk of a marine and tropical aquarium retail store. The participant, one of two females in this study, had decades of experience in the ornamental fish sector as a retailer and as a tropical fish farmer. While she had very little scientific knowledge, the participant had extensive knowledge about the ornamental fish sector. Participant 12 had grown up on a fish farm and had been the owner of another aquarium retail store. She did not stock the GloFish™ due to its high price and smaller margin. The tone of the interview was positive, but the hype of the GloFish™ had faded from the first interview.

Economics was the primary driver in participant 12's decision to not stock the GloFish™. Overall, stocking decisions were driven by customer demand and product attributes, but ethics

played a secondary role by limiting what she would be willing to stock. Her responses focused on the economics and morals in the aquarium industry. The participant was interested in breeding healthy fish and maintaining clean tank environments. In the interview, there was a tone of disapproval of many aquarium retailers' business practices as well as the attitudes that many aquarists have regarding their responsibility to their aquatic pets.

Product Attributes

Little time was spent assessing the rankings of product attributes. Color, survivability, and price were the most important to participant 12. Personality was never mentioned as a valuable product attribute in interview 12. The uniqueness of the fish's physical attributes was inferred to be an important to the customer. The participant referenced that mutant fish from China and Japan, that would have been culled by American fish farmers, had markets in the United States.

Aesthetics, specifically color, were the most important. She was asked what customers look for in a fish, and she emphasized the importance of coloration and health. She responded, "[if the] appearance of the product looks good, they're going to buy it." Additional questions were asked about what unique attribute would make the GloFish more desirable than nontransgenic zebra danios. She answered, "In other words because it would be attractive to a customer. The coloration. Instead of a zebra, [it] now has red and green and colors to it, which would attract the customer." Color continued to be the lead attribute.

Another primary concern for participant 12 was the fishes' health and survivability. She believed the importation of foreign products, especially fish with mutations and diseases, was hurting the industry. She stated the importance of survivability in multiple paragraphs, and contended that selling an unhealthy fish would reduce customer loyalty. While color, and cost were important factors, her greatest concern was survivability.

Price, while it was a factor, did not significantly impact a customer's buying decision. Participant 12 stated, from that perspective of her customers, that, "If I really want the fish I'll pay for it." However, it should be noted that it was the cost to the retailer, not the price of the fish that kept the GloFish™ out of the store. It was the cost of the fish to the retailer, rather than the price of the fish to the customer that concerned her.

Economics

As a manager, she was focused on customer management and keeping the fish healthy rather than the financial operations of the business. When discussing the cost of the fish, she immediately pulled on her experiences as a tropical fish farmer. While she did not believe that customers would be unwilling to pay for the fish, she believed that the retailers would be unable to afford to carry the GloFish™. "There's only certain fish farmers that are going to have the ability to do that, that have the money behind them. I mean a fish farmer like me. A mom and pop operation is not going to be able to afford to do that." She did believe there would be an adequate market to stock the fish at pet shows where large inventories are turned over daily.

Her decision to stock new fish was based on consumer demand; however, it was unclear how much influence she had as a manager. When she was asked to describe the criteria the store used to decide to stock fish, she responded, "Probably the best one would probably be demand." She mentioned that some retailers and farmers used surveys, but she used trial and error to see what was sold or not. She elaborated, "If it's a brand new fish, you would start out with limited quantities. Maybe you bring in 15-20. If they would sell them, you maybe go back and bring in maybe 30 more."

While perceived demand was the primary driver of what fish was stocked, she did have ethical boundaries. When she was first asked what she would be unwilling to sell, she replied, "Anything that is basically prohibited by law." However, she did refuse to sell a painted fish that

had ‘I Love You’ tattooed into its side. Not only was she unwilling to stock the fish, but she also believed that there would be a market for it. She commented, “It will sell. Believe me. I wouldn’t buy it. Put it this way, if I had a pet shop I wouldn’t stock them.” It was clarified in a follow-up question that her reasoning was not economic, but that the fish was injured and its health was jeopardized.

Jurassic Park Effect

The Jurassic Park effect played a minimal role in influencing participant 12. She realized that invasive species were a problem, but she did not indicate that she had fear of any environmental cataclysm from selling the GloFish™. To her the transgenic fish was another marketing gimmick similar to the painted fish. She was blunt in stating that she was a simple fish farmer that did not worry about the science behind her work. Her tone indicated that she trusted humanity, and while she did not know the regulatory agency tasked with GloFish™ oversight, she believed governance was in capable hands. She trusted the regulatory agencies, stating, “I think they do a good job because I have friends that work out there doing that.”

Ethics Category

Participant 12 did not suffer from the ethical paradox faced by many retailers. She disapproved of marketing deformed fish that would not survive for health reasons, and of painted fish. She was willing to sell anything that was legal. The painted fish heavily influenced the participant. When she was asked about the painted fish, she noted that it was unnecessary, but profitable.

I think it’s stupid. It sells, but to me it’s not necessary. You’re taking, you’re changing, you’re altering the fish’s skin tissue because you’re actually taking paint and injecting into, it’s like tattoo, basically same thing a tattoo, you’re taking and putting blood, you’re pushing the tissue and coloring the tissue.

Once again, there was some transference of the painted fish to the GloFish™. When she was asked to discuss other genetically modified organisms, she immediately began to discuss painted fish. When she was specifically asked to divulge her thoughts on the painted fish, she responded, “I think it’s stupid. It sells but to me it’s not necessary” (Paragraph 89). To her, the GloFish was potentially another way to scam uneducated customers into buying a highly colored fish. “I don’t like anything that [is] a trick because . . . [I do not like] tricking the consumer.” The combination of reduced survivability and the fading of the coloration made the painted fish an inferior product. The physical pain of the fish was not the primary driver, it was that the process damaged the fish’s health and reduced its survivability.

The fading of the color was her primary concern. She mentioned that customers had returned to complain that the fish lost its color, but it was unclear from the interview if customers complained about the painted fish’s compromised health.

Well like on a Painted Fish, they don’t last. You may get a Painted Fish. Say if it takes you three to six months to sell this fish it’s going to lose their color because it’s basically just dye that’s been dyed into the tissue. A Painted Fish does not maintain its color. If lucky it may maintain its color for six months.

She also described how the fish’s health was compromised. “You’re altering the fish’s structure because first you have to knock him out. You’re scraping the tissue, you’re scraping all his scales off, so actually in the long run you’re hurting the fish cause you’re taking away all of his natural protection.”

The participant placed the GloFish™ in the same group as the painted fish. Before the interview, she assumed that the transgenic fish had similar shortcomings to the tattooed fish. The participant admitted that as long as the GloFish™ was healthy there would be no reason to refuse to stock it. Thus, it was health concerns, along with cost, that caused her to not stock the fish.

Participant 12 would be willing to sell any fish that was profitable and likely to survive. When asked what fish she would not sell, she first said anything that was legal. She went on to clarify, however, that she would not sell “any fish . . . that was naturally deformed automatically got thrown out. . . . That’s something I wouldn’t sell, to me it’s a deformed fish. I don’t care how colorful you make it.” Participant 12 acknowledged foreign competition as a great concern. Specifically because they would breed “deformed” fish that provided a unique fish for the markets. While she worked for a fish farm, they worked to remove unhealthy mutations even though the characteristic made the fish have more desirable product attributes.

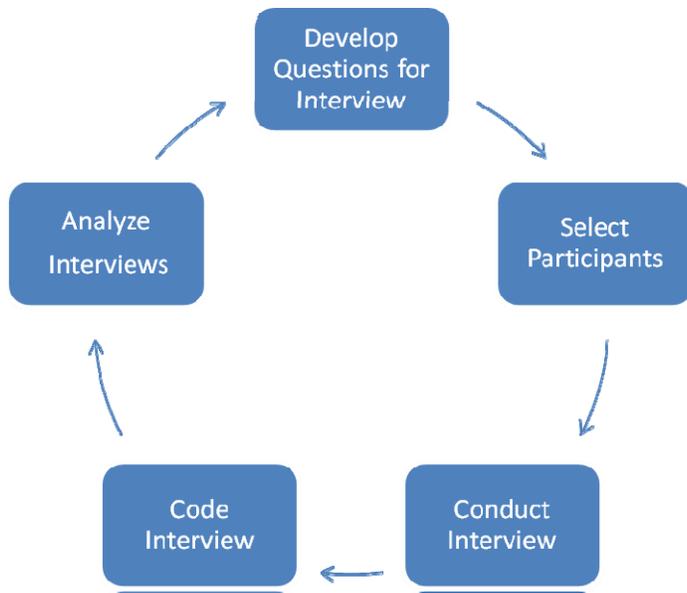


Figure 4-1. The Grounded Theory process



Figure 4-2. Product attributes price and color relationship

CHAPTER 5 CONCLUSIONS

Summary

There were a variety of factors that influenced retailers' reaction to the onset of transgenic fish. Ultimately, the profit motive drove stocking decisions, but was limited by ethical boundaries and influenced by a fear-based phenomenon, the Jurassic Park effect. When the interviews began, the entire reaction of the retailers' to the introduction of transgenic products was being investigated. As the research continued, the reaction was explained by the categories containing more than 150 unique codes. The retailers' reaction was summarized into whether a retailer stocked or did not stock the GloFish™. The reaction, encapsulated by stocking decisions, hypothetical or otherwise, served as the foundation to build the categories.

While stocking or not stocking the fish is binary, the actual attitude towards the stocking decision was varied. There were several retailers who stocked the fish, but were not enthusiastic about the fact they were selling a transgenic product. For these retailers, the profit motive was adequate in overcoming their reluctance to sell the GloFish™. However, once the threshold of moral acceptability was breached, the fish would never be sold. If the participant believed that there was severe moral dilemma with stocking the fish, then no amount of money or desirable product attribute would justify stocking the fish.

The economic value of the fish was heavily influenced by the product attribute category. Product attributes explained the retailers' perception of customer demand. While color was the overwhelming attribute that drove demand in aquarium hobby, price dictated the final buying decision. Half the retailers who refused to sell the GloFish™ did so for moral reasons while the other half mentioned the high cost of the fish as the reason to not stock them.

A grid was developed to capture who could sell the GloFish™ (ability) with desire to sell the GloFish™ (desire) (Table 5-1). Not all participants could stock the GloFish™ such as strictly marine retailers, therefore, grouping those participants in the same category as the people who refused to stock the fish would not accurately explain the stocking decision. Quadrant 1 was for the participants who stocked the fish, while quadrant 2 included those retailers who wanted to stock the fish but could not since they specialized in other products. Quadrant 3 contained retailers that had no ability to sell the fish, but would never sell the fish even if they could. Quadrant 4, contained those participants who had the ability but no desire to stock the GloFish™.

Five participants were not able to sell the GloFish™. Several participants (2, 5, and 8) were strictly marine retailers, interview 3 was done on an aquarium manufacturer, and participant 6 owned an aquarium servicing company. Five of the twelve participants stocked the GloFish™, and all cited that the decision was economic. Three additional participants would have stocked the fish if they were able. Therefore, the majority of the participants, 67%, embraced the GloFish™ as a profitable and ethical product. There was not an interview where the fish was stocked without any regard to profits. Participant 3 was unable to stock the fish, but hypothetically would have refused to sell the fish on moral grounds. The closest any participant was to being purely a hobbyist was interview 8, who only sold one specific type of fish, cichlids. Finally, while participant 11 mentioned that the transgenic fish was stocked as a more ethical alternative to the painted fish, ultimately, her primary impetus in stocking the fish was profitability.

The Economic-Cognitive Model

The economic-cognitive model explains the reaction of Florida aquarium retailers to the GloFish™ (Figure 5-1). Profit motive drives the economic-cognitive model which is divided

into five categories: economics, product attributes, the Jurassic park effect and ethics. When the stocking decision was made, the original motivation was to meet customer demands. The economics category describes the reactions towards the business aspects of selling transgenic fish. The product attributes category contains codes that constitute the fish's perceived desirability. Product attributes reflects customer demand which directly impacts the economic category. Next, the ethics category has codes which enable the retailers to validate or reject stocking the GloFish™ regardless of profit motive. Along with cost, ethics most heavily influenced stocking decisions. The ethics category was the most sophisticated since the boundaries and limitations on what participants were comfortable with was highly variable. Finally, influencing, but not dictating, stocking decisions, the last category, the Jurassic Park effect is included in the model.

Creating a rigid hierarchy of importance for the categories would be impossible, since under certain circumstances economics, ethics, or product attributes could more fully explain a retailer's reaction to suppliers offering transgenic products. Rather, the categories influence each other. Economics ties closely with the product attributes, and ethical litmus is used to determine if the fish should be stocked. The Jurassic Park effect, however, does not directly impact the retailer, but served to strengthen their position for or against the GloFish™.

Ethics

The ethics category was one of the earliest categories to manifest from the interviews and has a threshold rather than being linear (Figure 5-2). Thus, each participant had a cutoff point where no new product could be justified. The ethics cutoff point, while varying by participant, technology, and personal character, was heavily influenced by the perceived social value of the act. However, any benefit, social or economic, could not be justified if the fish past a participant's ethical limit. Social benefit was a major contributor to altering a participant's

ethical limit. This was referred to as a Machiavellian approach, since if the resulting product benefited society, then the means were less important. However, if the social benefit was not large, then the means of creating the product became more important to the retailer. No retailer believed that genetic modification could be justified to enhance the coloration of pets, but since it was available, the majority was willing to sell it.

The ethics category was the most elusive since it addressed participants' feelings and perceptions about the GloFish™ (Figure 5-3). Codes in this category described the, "I just do not like it" and "It is something that you should not do" responses. Ethical policing of aquarium hobbyists appeared in interviews 5, 8, 10 and 11. They perceived their roles as policeman of the aquarium industry who needed to set examples of what type of fish people should buy and ensure that the customer was able to meet a fish's demands. Ethical policing manifested in participants who were heavily influenced by the ethics category.

Playing God, religion, and Mother Nature themes emerged in many earlier interviews, but were less apparent as the research continued. The reason for the reduction of their appearances could not be determined from the interviews, but might be related to the more mainstream acceptance of the GloFish™ eighteen months later. In addition, explaining their relationships in the ethics category could not be done beyond placing them in the category. Playing God appeared to be the most influential retailers' initial reaction to the GloFish™, but subsequently did not influence stocking decisions. As well, one of the most staunchly opposed participants, participant 3, attributed his position to his religion. As well, comments such as "you should not mess with mother nature" appeared throughout the interviews, but their relationship with other codes and categories remains unknown.

Environmental issues appear in both the ethics and the environmental categories since several participants believed it was their responsibility to protect the environment. However, the ethics category was more impacted by elusive moral issues, such as Playing God, than a retailer's ethical obligation to protect the environment. While environmental concerns played an ancillary function in the ethics category, they significantly influenced the Jurassic Park effect.

Finally, the business versus ethics codes appeared frequently in the interviews. An ethical dilemma, the retailer's paradox, helps explain the relationship between profitability and ethics. The paradox manifested in the interviews when economic gain trumped pure moral decision making. For example, mortality rates are highest on fish that may have the greatest profitability, rare marine fish, and despite knowing that a fish will die, retailers are driven to meet customer demands. If they are good business people then they must compromise their ethics and if they compromise their ethics, then they will be unable to stay in business.

The retailer's paradox is tied to the ethics category since the importance of making money was variable among participants. The retailer's paradox became more evident when ethical boundaries were pushed rather than economic boundaries. The success of the painted fish exemplifies the paradox. While no retailer embraced the concept of harming a fish to enhance its marketability, some were willing to sell painted fish.

Product Attributes

The product attributes represent perceived customer demand. The ranking of importance of the attributes varied from participant to participant, but only participants three and eight believed that color was not the most valued attribute. Survivability and variety were also mentioned in several interviews, but were not the characteristics that caught the attention of perspective buyers. The two characteristics were valued by advanced hobbyists, a small percentage of all the participants' core business (Figure 5-4).

Survivability themes appeared in both the product attribute and ethics categories. Survivability was more influential from the ethical rather than economic perspective. Fish health was always discussed, but not in the context of profitability. Survivability did not appear to be a primary driver in stocking certain fish exemplified retailers stocking rare marine and painted fish. While the GloFish™ had a much greater survival rate than the painted fish, participants were willing to sell the painted fish but not the GloFish™. As well, marine retailers stocked fish that had less than ten percent survival rates in captivity. Thus, survivability was not a significant product attribute.

Several participants also mentioned that they stocked the GloFish™ to provide customers with a variety of options. Two participants acknowledged that it allowed them to differentiate their offerings from large retail chains. However, the importance of variety was of much less importance than profitability. If the GloFish™ was perceived as either not profitable or immoral, then demand for a variety of fish was mitigated (Figure 5-5).

The product attributes category directly impacted the GloFish's™ perceived economic value (Figure 5-6). As well, the cost of the fish directly determines the price that a retailer must ask for the fish. Thus, there is a reciprocal relationship between the product attributes and economics categories. Several participants believed the product attributes were not valuable enough to justify the high cost of stocking the GloFish™. The intense coloration did not justify the high price of the fish. Participant 12, and 10 noted that the cost of the fish was the reason why they would not stock it. Participants who reported slow sales also mentioned the price of the fish, along with close substitutes for less money, were to blame.

While it was clear from the interviews that customers wanted intense coloration for a reasonable price, the decision to stock the GloFish™ was not done on product attributes alone.

If fish were stocked based on product attributes alone, then no retailer would have refused to stock fish that were profitable and good for business. The product attribute category feeds the economics category, which then required ethical approval.

Jurassic Park Effect

By interview 10, the dimensions of the Jurassic Park effect manifested as trust, and risk. First, trust can be trust in humanity, science, or government. In any form, it can influence if a person experiences the Jurassic Park effect. Participant 7, while perceiving a risk in the possible release of the fish, did not have a strong influence from the effect because of a high level of trust in the federal government. If a participant has a high degree of distrust as in interview 3, 5, and 8, then the likelihood of them being heavily influenced by the Jurassic Park effect is high (Figure 5-7).

The second dimension, perceived consequences, also influences the effect. Participants who do not fear the consequences of selling the GloFish™ will never be heavily influenced by the Jurassic Park effect. Thus, the effect has a minimal impact unless the perceived consequences are great. Since, he did not perceive either the GloFish™ or another transgenic fish to represent a significant threat to either the environment of humanity, the impact of the effect was mitigated.

The importance of the regulatory family had been in question since interview 6. The regulatory family of codes appeared in the interviews, but it was determined to be driven by trust. The relevance of the regulatory category to a retailer's perception of the GloFish™ was minimal since it was trust that ultimately drove the response. The regulatory codes were rolled into the Jurassic Park effect category following interview 6, since trust is the influential element (Figure 5-8).

Participants who do not fear the consequences of selling the GloFish™, however, will never be heavily influenced by the Jurassic Park effect, despite their level of trust. Participant 9, while having a high distrust for government and humanity, did not perceive the consequences of release as significant. Thus, the effect has a minimal impact unless the perceived consequences are great. Since, Participant 10 did not perceive the GloFish™ or another transgenic fish to represent a significant threat to either the environment or humanity, the impact of the effect was mitigated.

Neither participant 11 nor participant 12 was heavily influenced by the fear resulting from the phenomenon. Overall, the phenomenon influenced the stocking decision, but was never cited as the primary reason to not stock a fish. There is a nonlinear relationship between the two dimensions trust and risk (Figure 5-3). If perceived risk is great enough, then despite the trust dimension, the affected party will have a fear response. This can be observed in people who fear flying, and genetically modified foods.

No retailer claimed “nature will find a way” as justification for refusing to stock the fish. Participant 5 was the most strongly influence by the effect since he not only had low levels of trust, but also had a high perceived consequence. He did, however, state that he would sell the fish out of economic necessity if his core business failed. Ultimately, the ethics and economic categories are much more significant influences on a retailer’s decision to stock the fish. In the hierarchy of influence, economics and ethics, in that respective order, play a more significant role in influencing stocking decisions. Participants 3, 8, and 10 did so out of ethical reasons (Figure 5-9).

Economics

The economics category emerged as a series of codes addressing the business aspects of being an aquarium retailer. After interview 4, the differentiation was made between price, a

product attribute, and cost, an economic attribute. Retailers sell fish to make a profit and to stay in business. As participant 1 noted, “We are all in business to make business” (Figure 5-10). Codes capturing this sentiment were placed in the economics category (Figure 5-11).

There were numerous factors that contribute to owning and running an ornamental fish retail business, but no retailer believed that they could operate without paying their bills (Figure 5-12). Ethics, while cited as a reason to not stock the fish, was secondary to the profitability. First, the retailer had to pay the bills, and second, they had to be ethically comfortable with selling the fish. While the economics category generally explained a retailer’s decision to stock or not to stock the fish, there was an ethical cut-off where no amount of profitability would be justifiable.

Table 5-1. Who sold the GloFish™

		Ability To Sell GloFish™	
Desire To Sell GloFish™	1	Yes: Ability Yes: Desire Sells GloFish™ 1,4,7,9,11	No: Ability Yes: Desire Would Sell GloFish™ if Could 2,5,6
	3	No: Ability No: Desire No Sell GloFish™ 8,3	Yes: Ability No: Desire Would Not Sell the GloFish™ if could 12,10

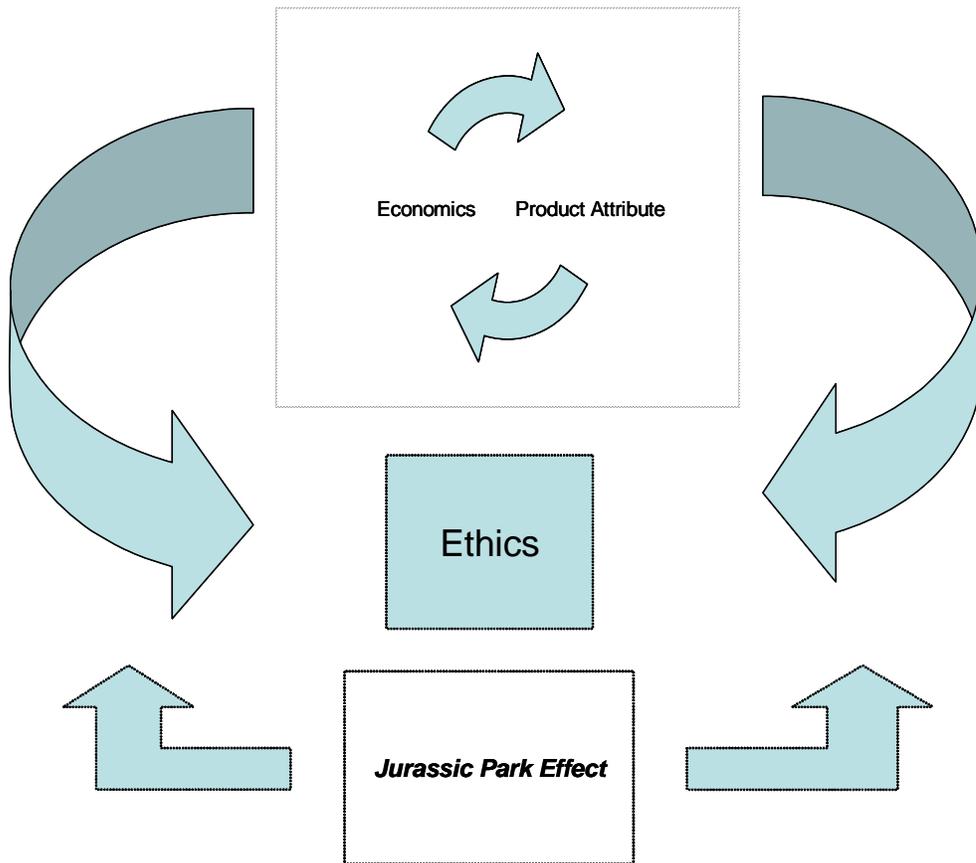


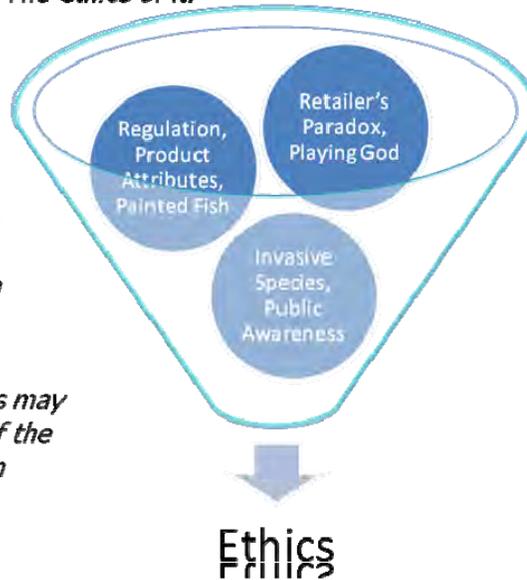
Figure 5-1. Economic-cognitive model

Ethics Category

"I don't think it's the unsafeness or dangerous as much as it is the – as much as it is: should we be doing it? The ethics of it."

"I think it's an extension of what we are. To not do it would be, I think foolish, because there are so many good things that come from that."

Some individual stores may not carry it because of the ethics thing and it's an aberration."



"Overall I think it is a good thing, and it's probably something that has to be done, mainly for the future of our race, and life in general. Some of it is kind of wishy-washy in ways and I guess you could say a little frightening in other areas."

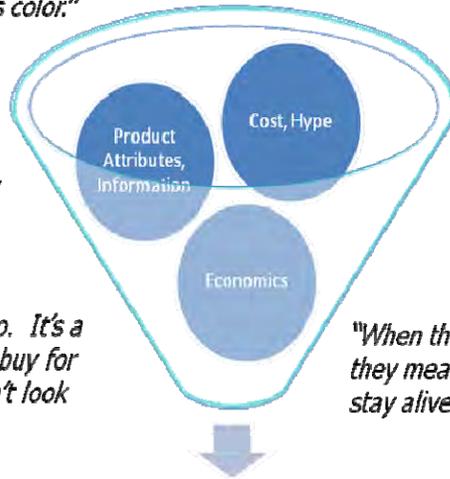
Figure 5-2. Ethics category

Product Attributes Category

"People love color. People go down our last aisle of salt water and are like, whoa, I want that! I think it is color."

"The vast majority of people, 80% are buying fish because they like the way they look."

"It's a five dollar Danio. It's a fish you can normally buy for 99 cents, and it doesn't look that much different."



"A lot of fish do have personalities, but a lot of people like the color."

"When they say 'is this fish hardy,' they mean if I neglect it, will it stay alive."

Product Attributes

Figure 5-4. Product Attributes Category

Product Attribute Rankings

Some variability depending on type of retailer (tropical vs. marine)

- 1. Color** – Customers demanded vivid, intense coloration
- 2. Price** – How much a customer is willing to pay
- 3. Personality** – Movement, Aggressiveness



Ancillary Attributes: Variety, Survivability, Uniqueness, etc.

Marine Retailers	Tropical Retailers
Color	Price
Personality	Color
Price	Personality

Figure 5-6. Product attribute rankings

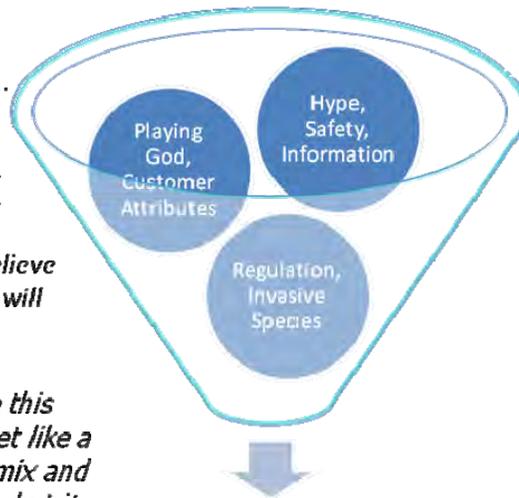
Jurassic Park Effect Category



"Every time they try something crazy, it usually doesn't work ... they always think the blob's going to be formed ... and it's just not going to happen."

"...nature finds a way. Believe it or not, it will. I think it will survive. I think it could happen."

"I think humans make this unsafe because you get like a mad scientists. Let's mix and this and this and see what it does."



"For example, fifteen to twenty years down the road, one gets in a pond and what happens if they start sprouting little tentacles ... like the anemone, I mean the possibilities ... everything evolves to environmental conditions ... we just don't know."

Jurassic Park Effect

Figure 5-7. The Jurassic Park effect category

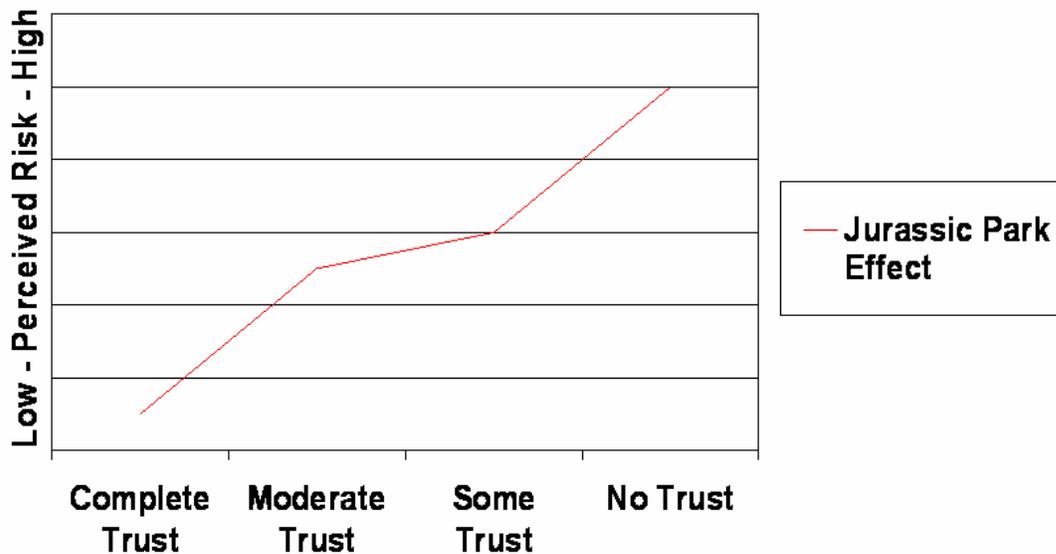


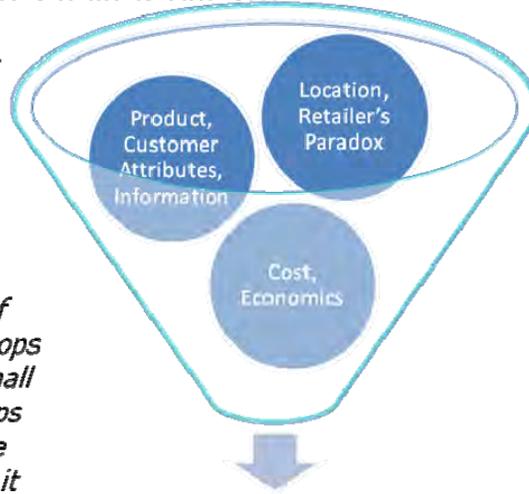
Figure 5-8. The Jurassic Park effect: Risk vs. trust relationship

Economics Category

"We are in business here to make business."

"I mean a fish farmer like me. A mom and pop operation is not going to be able to afford to do that."

"[It] is just the price of them. The two pet shops that I deal with are small mom and pop pet shops and they just don't like spending \$2.50 to get it in the shop."



"The reason I think is that some people will carry this type of fish and some people won't is some people are hobbyists and got into the business as a hobby and will probably be out of the business as a hobbyist and some people are in it as a business."

Economics

Figure 5-10. Economics category

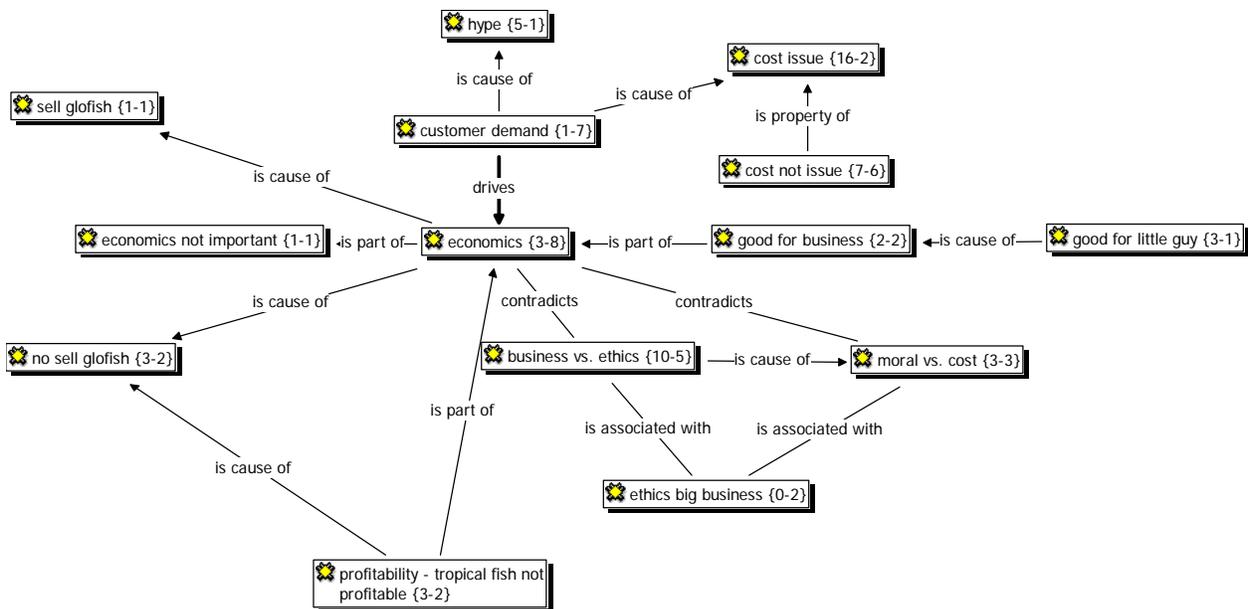


Figure 5-11. Economics category network of codes

		High Profit			
Low Morals	High Profit High Risk Low Morals	High Profit Low Risk Low Morals	High Profit High Risk High Morals	High Morals	
	High Profits Low Risk High Morals		Low Profit Low Risk Low Morals		
	Low Profit High Risk Low Morals	Low Profit Low Risk High Morals	Low Profit High Risk High Morals		
		Low Profit			
				<div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="width: 20px; height: 15px; background-color: black; border: 1px solid black; margin-right: 5px;"></div> No Sell </div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="width: 20px; height: 15px; background-color: #d9ead3; border: 1px solid black; margin-right: 5px;"></div> Maybe Sell </div> <div style="display: flex; align-items: center;"> <div style="width: 20px; height: 15px; border: 1px solid black; margin-right: 5px;"></div> Sell </div>	

Figure 5-12. Economic, risk, ethics table

CHAPTER 6 FUTURE WORK

The economic-cognitive model opens itself to a number of ancillary research questions, which can be grouped into four categories depending on methods and population selected (Table 6-1). The first dimension, population, describes research on either the same (specified) or different (expansion) populations. Expansion research selects populations, other than aquarium retailers, which would enhance the model's transferability and credibility. Likewise, specified future research uses the same population, but more participants, and continues to build on the existing model to explain new phenomenon. The second dimension, methods, describes the methodology, quantitative or qualitative, used to investigate the population selected. Both methods, depending on their use, could either build new theory or enhance the transferability of the existing research.

For the first quadrant, qualitative expansion research could apply the economic-cognitive model to populations where similar biotechnologies are being introduced such as xenotransplantation and stem cell research. Elusive phenomenon identified from this research could be further examined in differing populations using qualitative methods. A grounded theory of the public's response to stem cell research could use the methods and interview questions from this research. Future research could apply the model to hospitals adopting new biotechnologies, and the similarities and variances could be explained. The economic-ethical model could be applied to retailers of stem cell derived technologies, and the influence of the Jurassic Park effect in stem cell research could also be examined. Finally, understand which populations continue to support the economic-cognitive model would reveal its parameters of transferability.

For the second quadrant, the population and methods both vary from this research. Therefore, second quadrant research would be the most powerful in adding support to the economic-cognitive model. The challenge to the researchers would be creating a quantitative representation of a qualitative study. The economic-cognitive model could be translated into quantitative research such as surveys, and the survey questions could be used to triangulate findings from other populations. If the model continued to function in dissimilar populations using quantitative tools, the credibility of the findings would increase significantly.

The research in the third quadrant would continue to use aquarium retailers and qualitative methods. A case study on York Town Technologies would pool information from a variety of schools to gain a different perspective. Other research in quadrant three could use grounded theory to continue to further investigate the boundaries of the Jurassic Park effect. Given resource constraints, no participant was interviewed who did not stock the GloFish™ because of the Jurassic Park effect. Thus, finding the outlying participant would further strengthen the model. As well, additional time could be allocated to better understanding the cognitive processes contributing to the fear of the unknown driving the effect in aquarium retailers. Finally, the retailer's paradox could be further researched to gain a better understanding of selling controversial products. Aquarium retailers provide a unique population to examine the paradox using qualitative methods.

The fourth quadrant would use quantitative techniques on the aquarium retailer population. There has been quality survey research done by pet associations, but specific survey research on the GloFish™ is lacking. From the perspective of enhancing the model and continuing the research, translating a qualitative phenomenon into quantitative measures continues to pose unique constraints. However, many economic questions could be addressed in the model using

quantitative methods. Price elasticity and its impact on the economic-cognitive model would be a helpful addition. Relationships between color and price, and maximum price points could be determined by analyzing retailers' sales data.

Overall, future research should examine the model's relevance in other populations experiencing the introduction of a controversial technology. In addition, quantitative measures from the model must be developed to help triangulate findings. The value of the economic-cognitive model will be in understanding how similar populations will react to biotechnologies. Thus, future research should strive to strengthen the model's transferability and triangulate the finding with quantitative research.

Table 6-1. Future research

		Methods	
		Expansion Research–Qualitative	Expansion Research–Quantitative
Population	Methods Quadrant 1	<p>Questions:</p> <ol style="list-style-type: none"> 1. Does the economic-cognitive model appear in hospitals adopting new biotechnologies? 2. What influence does the Jurassic Park effect have in stem cell research? 3. What impact does the economic-ethical model have on stem cell research derived technologies? 4. What new technologies experience the economic-cognitive effect when introduced? 	Methods Quadrant 2
	Questions:	<ol style="list-style-type: none"> 1. Does the economic-cognitive model appear in hospitals adopting new biotechnologies? 2. Does the economic-cognitive model significantly influence the public’s perception of stem cell research? 3. Does the economic-cognitive model significantly influence the public’s perception of xenotransplantation? 4. Does the Jurassic Park effect occur more in agribiotechnologies than in medical biotechnologies? 	
		Specified Research – Qualitative	Specified Research – Quantitative
	Methods Quadrant 3	<p>Questions:</p> <ol style="list-style-type: none"> 1. A case study of York Town Technolgies. 2. When does the Economic Cognitive model fail? 3. What are the cognitive elements of the retailer’s paradox? 	Methods Quadrant 4
	Questions:	<ol style="list-style-type: none"> 1. What is the price point that negates the economic-cognitive model? 2. How strongly are price and color related? 3. What is the economic value of coloration? 4. What is the price elasticity of the GloFish™? 	

APPENDIX A
FDA STATEMENT

FDA Statement Regarding GloFish™

Because tropical aquarium fish are not used for food purposes, they pose no threat to the food supply. There is no evidence that these genetically engineered zebra danio fish pose any more threat to the environment than their unmodified counterparts which have long been widely sold in the United States. In the absence of a clear risk to the public health, the FDA finds no reason to regulate these particular fish. (FDA, 2003)

APPENDIX B
INTERVIEW PROTOCOL

Pilot Interview Protocol I (Interview 1)

interview Protocol

Project: Stakeholder Response to Transgenic Ornamental Fish

Time of Interview:

Date:

Place:

Interviewer:

Interviewee:

Position of interviewee:

Level of Education:

Scientific Background:

Description:

The purpose of this grounded theory study is to understand the responses of stakeholders (retailers) in the ornamental fish industry to the onset of transgenic products. At this stage in the research the central focus will be to obtain stakeholder opinions about new ornamental fish developed with biotechnology and to come to understand the basis of their acceptance or disapproval of such products.

Questions:

Descriptive

1. Tell me about your experiences with the glofish.
2. Why did you decide to get involved with glofish? How did you hear about the glofish?
3. Describe what you think other aquarium retailers felt with the approval of the glofishfish.
4. Describe the range of opinions that you have heard about this technology.
5. Describe the technology used in your terms about how the GloFish was created.

Follow-up:

1. You mention: *Special interest group* :why?
Large retailer
California
Painted fish
GM Crops

Experience:

2. If you were once reluctant to sell the fish, then what made you change your mind?
3. Could you talk about your impression of genetic engineering?
4. Could you talk about your impression of biotechnology?

Structural/Paradigmatic

1. You said the technology is: *Safe*
Dangerous: what makes it so?

Compare and Contrast:

1. Compare and Contrast an individual for the technology with an individual reluctant to accept it.

Interview Protocol II (Interviews 2-3)

Interview Protocol

Project: Stakeholder Response to Transgenic Ornamental Fish

Time of Interview:

Date:

Place:

Interviewer:

Interviewee:

Position of interviewee:

Level of Education:

Scientific Background:

Description:

The purpose of this grounded theory study is to understand the responses of stakeholders in the ornamental fish industry to the onset of transgenic products. At this stage in the research the central focus will be to obtain stakeholder opinions about new ornamental fish developed with biotechnology and to come to understand the basis of their acceptance or disapproval of such products.

Questions:

Descriptive

1. What is it like to raise transgenic fish?
2. Describe an experience you had that made you question the safety of transgenic fish?
3. Why did you decide to get involved with transgenic fish?
4. What are the challenges and rewards to raising transgenic fish? How are they different from regular fish?
5. Describe how you felt when you learned that the FDA approved transgenic Zebra Danios for production.
6. Describe what you think other stakeholders felt with the approval of the transgenic fish.
7. Describe the range of opinions that you have heard about this technology.
8. Describe the technology used in your terms about how the GloFish was created.
9. What does the term transgenic mean to you?

Follow-up:

1. You mention: *Special interest group* :why?

Large retailer

California

Painted fish

GM Crops

Experience:

1. Could you talk about an experience you have had with the GloFish?
2. Could you talk about your impression of genetic engineering?
3. Could you talk about your impression of biotechnology?

Structural/Paradigmatic

1. You said the technology is: *Safe*
Dangerous: what makes it so?

Compare and Contrast:

1. Could you compare the characteristics of the transgenic fish to non-transgenic fish?
2. Compare and Contrast an individual for the technology with an individual reluctant to accept it.

Interview Protocol III (Interviews 4-9)

Interview Protocol

Project: Stakeholder Response to Transgenic Ornamental Fish

Time of Interview:

Date:

Place:

Interviewer:

Interviewee:

Position of interviewee:

Level of Education:

Scientific Background:

Description:

The purpose of this grounded theory study is to understand the responses of stakeholders in the ornamental fish industry to the onset of transgenic products. At this stage in the research the central focus will be to obtain stakeholder opinions about new ornamental fish developed with biotechnology and to come to understand the basis of their acceptance or disapproval of such products.

Questions:

Descriptive

1. What is it like to raise transgenic fish?
2. What do customers look for in transgenic fish?
3. Describe the level of knowledge consumers have about the origins of aquarium fish?
4. Describe an experience you had that made you question the safety of transgenic fish?
5. Why did you decide to get involved with transgenic fish?
6. What are the challenges and rewards to raising transgenic fish? How are they different from regular fish?

7. Describe how you felt when you learned that the FDA approved transgenic Zebra Danios for production. Did you know we had genetically modified fish?
8. Describe what you think other stakeholders felt with the approval of the transgenic fish.
9. Describe the range of opinions that you have heard about this technology.
10. Describe the technology used in your terms about how the GloFish was created.
11. What does the term transgenic mean to you?

Follow-up:

1. When we spoke on the phone you assumed that I was referring to:
Invasive Species?

Experience:

1. Could you talk about an experience you have had with the GloFish?
2. Could you talk about your impression of genetic engineering?
3. Could you talk about your impression of biotechnology?

Structural/Paradigmatic

1. You said the technology is: *Safe*
Dangerous: what makes it so?

Compare and Contrast:

1. Could you compare the characteristics of the transgenic fish to non-transgenic fish?
2. Compare and Contrast an individual for the technology with an individual reluctant to accept it.

Interview Protocol IV (Interviews 9-12)

Interview Protocol

Project: Stakeholder Response to Transgenic Ornamental Fish

Time of Interview:

Date:

Place:

Interviewer:

Interviewee:

Position of interviewee:

Level of Education:

Scientific Background:

Description:

The purpose of this grounded theory study is to understand the responses of stakeholders in the ornamental fish industry to the onset of transgenic products. At this stage in the research the central focus will be to obtain stakeholder opinions about new ornamental fish developed with biotechnology and to come to understand the basis of their acceptance or disapproval of such products.

Questions:

Ethics:

1. Why did you decide (to/ not) to sell the GloFish?
2. Describe what type of fish you would not stock?
3. Describe how you decide to purchase a fish to stock in your store?
4. Are there fish that you would not stock despite high potential profit? Why?
5. What is your take on invasive species?
6. When we spoke on the phone you assumed that I was referring to:
Invasive Species?
Painted Fish?

Consumer Attributes:

1. Describe the level of knowledge consumers have about the origins of aquarium fish?
2. What do customers look for in fish? What attributes do they find valuable?
3. Compare and Contrast an individual for the technology with an individual reluctant to accept it.
4. Could you rank what attributes consumers desire – how are they related?

Regulatory Family

1. In your own words describe the regulatory bodies involved in monitoring the GloFish?
2. How much faith do you have in the FDA?
3. Describe how you felt when you learned that the FDA approved transgenic Zebra Danios for production. Did you know we had genetically modified fish?
4. Describe what you think other stakeholders felt with the approval of the transgenic fish.

Jurassic Park Phenomenon

1. Could you talk about your impression of genetic engineering?
2. Could you talk about your impression of biotechnology?
3. What does the term transgenic mean to you?
4. What have you read in newspapers and heard on TV about the GloFish?
5. Describe an experience you had that made you question the safety of transgenic fish?
6. You said the technology is: *Safe*
Dangerous: what makes it so?

Science Acumen Indicator

1. Describe the technology used in your terms about how the GloFish was created.

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