The Biology of Markets:

Club Apples and the Social Life of Varieties

By

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A dissertation submitted in partial fulfillment of

the requirements for the degree of

Doctor of Philosophy

(Sociology)

at the

UNIVERSITY OF WISCONSIN-MADISON

2013

Date of final oral examination: 5/6/13

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Table of Contents

Abstract:

Club apples are new varieties that are associated with licenses that restrict the ways that they can be grown and sold. While the types of clubs that are emerging in the apple industry are diverse, they all have some sort of social boundary associated with them that is matched to the biological differences between varieties of apples. The clubs offer growers a new set of rules to operate within, along with new opportunities and constraints. Using clubs and the apple industry as a case, I build a theory of the biology of markets that emphasizes the ways that biological materials play a role in the organization of industries and the structure of economic markets. While recent work in actor-network theory and the new institutionalism in economic sociology have emphasized how materials and rules, respectively, influence action, this work brings the theories together and emphasizes the particular role that living things may play.

The three articles in this dissertation use different frameworks to explain the emergence of club apples. The first paper demonstrates that biological distinctions can be used to shape social and economic boundaries. I consider how the maintenance of varieties in the market have generated booms and busts as the popularity of particular apples climb and crash, but how they also provide a foundation for clubs that seek to stabilize those cycles. In the second paper, I consider how new technologies shape economic agency, but are contingent on the ability to re-negotiate institutional rules that structure production. Using dwarfing trees and trellis systems as an example, I describe how technologies can expand the

range of production activities, engender more customized orchard landscapes, and encourage more collaborative grower communities. I also suggest that these are only liberating insofar as they enable more control over markets. The last article suggests that clubs advance an economic ethic of varietal competition, where varieties act like brands and advance the interests of wholesale growers. The paper suggests that matter can act as a vehicle for institutional change. These three papers substantively contribute to a picture of a changing food industry, while providing insights into how biology matters for economic life.

Introduction

In the fall of 2011, at the age of 28, I finally got my drivers license. I had never driven before my first lessons the previous summer. In January 2012, I woke up at 5am and drove the icy roads to my first dissertation interview six hours away, and in the afternoon, I drove all the way home. It was my first day. It seemed appropriate to have this gauntlet marking the first field day: if I can get through this day, I thought, I *will* finish my dissertation. When I arrived at my interview I experienced the typical surge of anxiety, but it was alleviated by the sense that I had already faced death that day, having been wedged between three semi-trucks only an hour before, and having slid across the road only moments after beginning my journey. When I arrived, I pulled into a small gravel parking lot beside a small white building, and walked inside. A receptionist asked me to sit a moment, and then escorted me into an office where I met a tall, middle-aged man in jeans and a nice t-shirt, made more tailored by his sturdy stature. "What's your angle? What's your dissertation? I get the impression you're critical of managed varieties," he said. "I don't really know what I'm doing or what my angle is," I said, "and I have no idea what I think about managed varieties." I had some ideas, but they were hazy and weak. I had originally thought they were bizarre and inherently problematic. Words like "monopoly" and "cartel" and "genetic enclosure" came to mind. Once I started talking to people and reading about the apple industry, even before starting my interview research, my opinion started to change. The interview lasted four hours:

we talked for a couple of hours and then toured the orchard. I talked about patents and he asked why patents were such a bad thing, Monsanto aside. I saw high density orchards, rows of seemingly frail, vine-like trees emerging from the snow, strung along a trellis in perfect, almost two-dimensional lines, so that if you stood at the end of a row it would almost look like a single twig, pointing to the sky. He talked about the importance of choosing a good site, for the benefit of the orchard and the pleasure of going to work somewhere beautiful. His orchard sat on top of a hill. From the top you could look through the rows or trees and see miles into the snowy distance, and the space seemed open and expansive. I was critical about managed or club varieties, but I also thought, after that first interview, that I was probably wrong in some meaningful ways, and I would have to think a lot more about it. I believe I drove home in the dark with the floodlights on, which was incredibly frustrating because I thought they were the regular headlights and people simply managed to drive with extremely impaired vision. While I may have been a danger to myself and other motorists, that first interview made a lasting impression on me and over the next year I fell in love with the Midwest doing my interviews, however challenging I found them at times.

I did my interviews a year after massive protests erupted in Madison, Wisconsin about the passage of a strong anti-union bill. I had spent a week sleeping in the capital buildings, toting signs, and organizing the food tables. I only left to teach classes. After the protests were over, the politics continued to play out in Madison and the rest of the state as we all prepared for a recall election. While I had been comfortably nestled in the warm bosom of Madison's furious progressiveness

(only surpassed by the progressiveness of the university) the state was divided, and travelling through a bunch of Republican and Tea Party strongholds to ask people questions about plants, for my dissertation, put me slightly on edge. In general, the edginess was needless and quickly died away, after realizing that even people whose opinions differed vastly from my own were courteous, kind, and occasionally interested in engaging in respectful dialogue about things like public policy. On occasion, these conversations would be tense and uncomfortably brought into question my research, my livelihood, and my contribution to society. Was I just a lout living off the taxpayer's dime?

The most difficult interview I did to these ends was in the spring, when I had scheduled four interviews in three days, each of which required long drives amidst more mammalian roadside casualties than I have ever seen in my life. Having never been a real motorist before, this experience shocked my vegan heart. At the second interview, when I finished up with my closing question, "is there anything you would like to ask me?" the participant, a small scale grower involved in agri-tourism, inquired about my academic background. I described projects I had participated in during my Master's program in Canada, looking at resilience rural coastal communities. He began asking how such an expensive project, requiring relatively frequent plane trips along the coast, would be funded. Before I knew it, I was defending my dissertation project and justifying the expense of my interview with him. In an effort to make my project more efficient, he contacted a neighbor to talk to me later that day, and while I appreciated his effort, I was exhausted and had six more hours of driving, looming in the back of my head. In many cases, growers

contacted their neighbors and ask whether they had time to do an interview with me, and I was very grateful. Sometimes, the referrals had a paternalistic flavor, and in this case, it wore at my dissertating sprit. He absolutely insisted that I speak with someone else, and began calling people, ironing out the details of my appointment over the phone. I felt like a child whose parent was arranging an obligatory visit to a distant relative. I went home and wrote a long scathing field note about the wretchedness of sexism and fiscal conservatism. This, however, was merely a lead up to the moment I almost gave up on my PhD.

Two days later, I emerged at the top of a hill only to be met by a friendly dog and two shy but curious children, who hid behind a pickup truck. A woman emerged from the house, and we sat outside on a picnic table and talked about her orchard. She and her husband had been saving for the orchard for a long time after finding other work unreliable and unfulfilling. At the end of the interview, we began talking about the experiences of a Canadian in the United States, and thereafter, the relative taxation schemes existing in the two countries. Inevitably, the conversation diverted into a conversation about the funding for my dissertation. I fumbled through and departed the interview with a sense of mutual civility and respect, while also feeling uncomfortable and defensive. She did not tell me what I should do, or express any outright judgment, but there was a moment when I felt suddenly so strange and unlikeable in her eyes, and rather than inciting some sense of righteousness, as it had before with my previous condemnatory experience, I felt self-conscious and guilty. If growers thought my project was a frivolous and wasteful, how could I justify all the time spent doing interviews, burning gas, and pondering apples, of all

things. Apples?! Was my research obscure, self-indulgent, and totally useless? Why wasn't I studying poverty? After all, doing research is a huge expense and graduate school overall has made my social life almost non-existent and my skill-set, shockingly narrow. As I drove back to Madison on the four-lane freeway, tailed by semi-trucks and surrounded by a blossoming spring, I saw yet another dead animal in the middle of the road: a raccoon maybe. As I got closer, I realized it was not a dead animal at all, but a duck slowly escorting her brood across the freeway. Terrified of causing a semi-truck pile-up, I drove right over those ducklings, breaking concentration only for a moment to observe the cloud of feathers that exploded behind me. I pulled over at the next rest stop. I spent about twenty minutes pacing about and making use of my emergency pack of stale cigarettes, hidden in my car for such events, and cursing academia. I decided to try to make it back to Madison before dusk, so as to avoid also mauling a deer in the same trip.

"Do you come from a farming background?"

Almost everyone I interviewed asked me whether I came from a farming background. It was clearly an effort to discern my motivations and angle, and sometimes was followed by questions about how I came to be interested in apples. I tried to pitch a few different narratives about my path, but generally mentioned something about being captivated by apples in an aesthetic and cultural way as a child and developing an interest in cooperative aspects of the apple industry in British Columbia. This seemed to be an acceptable response, although I was fetishizing apples in a way, and sometimes the following discussion would emphasize the way that there was nothing special about apples, and it was just like

producing anything else. I came to learn that there is a real effort to create an image of apple production as hard labor with little reward, discouraging the idea of a pleasant and leisurely production in a quaint hobby landscape. I sometimes talked about having done work in fishing and logging communities in British Columbia, and having some interest sparked in economies that have a relationship to dirt, plants, fish or water. This was more of a hit and miss, and sometimes portraying myself as some type of expert with theoretical questions seemed to create a suspicious response among growers. I had a difficult time deciding what exactly to tell people, and wanted to ease the strain of being an outsider, but I had to embrace the position of what Simmel (1908) calls *the stranger*. The potential wanderer: here today, maybe here tomorrow. I also wanted to be clear about who I was and my standpoint, for the sake of being clear about my position so that their participation was truly voluntary. My role in the industry was not one that was natural or easy to place, and while I knew more about apples than most people, I certainly was not an industry insider. My existence warranted an explanation and my role needed conceptual placement, and I was happy to provide one. I started my research thinking that my ethics would lead me to simply be honest. On the other hand, I felt compelled to manage the impressions that people would have. I did a lot of *facework*, as Goffman (1955) would say, where I tried to give off signals that would lead people to interpret me the way I saw myself, and it was much harder than I had anticipated. For example, I realized that when I mentioned that I was a graduate student in the Department of Community and Environmental Sociology, people often interpreted my work as inherently about environmental issues and would

either avoid or dwell on topics like pesticide use and food safety. While identifying as a student in Community and Environmental Sociology was perhaps more honest, it also seemed to generate a misrepresentation of my intentions, which were not really environmentalist, and certainly not environmentalist in the ways that they seemed to be assuming. Navigating the world of self-presentation was an ongoing process, and futile in the end because the people I spoke to were so incredibly diverse in terms of their politics and backgrounds. My approach was generally to avoid masking any of my politics and background, but clarify my position when it seemed to have been misinterpreted. So, when people asked me whether I came from a farming background, I sensed that it was an attempt to decide whether I was an insider who would understand the culture of farming or a liberal city girl looking to intellectually and self-indulgently frolic amongst apple trees or alternatively, pick a food fight. Of course, I had intended to do a bit of both, but I had no idea how or why and I tried to make that as clear as possible.

I spent some time thinking about my position as a researcher and how I should represent these apple stories analytically. The findings are certainly a product of my own character, kind of a city girl with politics that lean much more radical than liberal. The stories I chose to tell, and how I chose to tell them, are informed by what I think is important. In my defense, I have been studying sociology for a while, and my academic background has crafted the questions I decided to ask. Is the product of my labor useful for the population I'm studying? Probably not. Is it a waste of time? Probably not, but what even constitutes a waste of time anyways? I spent some time defending myself to farmers, graduate students, and acquaintances,

avoiding the honest truth that I was struggling as much with self-doubt about the purpose of my research as the idea that research must always be efficient, productive, and purposeful, and that it was somehow my job to justify what I was doing. To some degree, the growers I was interviewing were doing the same thing when they described their orchard, and the clubs they were joining or the efforts they were making to produce more apples on smaller areas of land.

People I was interviewing had every right to call into question my character and the degree to which they would benefit (or suffer) from my work. I had my opinions about their practices and the narratives they used to situate those practices, and I will be putting them all into my own analytic frame in the following pages. The story I chose to tell is incomplete. It is a partial vision fragmented by my desire to tell a story that resonates with me and that seems fair to the people who took the time to talk to me and allowed me to glimpse into their world. I tried to get to know my subject well so that I could make arguments that made sense to me without betraying what I observed. I've been working on the theoretical aspects of the work for a long time, and my vision has been altered to see things in ways that relate to those ideas. In other words, there is nothing objective about the articles I wrote, but I have tried to suppress any desires to be entirely self-interested and self-indulgent. I employed a few strategies to try to tell a story that recognized my own position as a scholar trying to finish a PhD, while also being fair and respectful.

One of the strategies I used was to focus on a topic that came from growers. I had intended to study organics and institutional change, but organic apples did not seem to gain much traction. When conducting a pilot study in 2009, club apples

came up several times, and seemed to be a topic that people had an opinion about and wanted to talk about. The more I learned about these clubs, the more I thought they would be a good topic to focus on. I also kept my interviews fairly open-ended, and adapted my questions as I went along. I learned what questions were good questions, and fit the topic, and which were illogical or fell flat.

I did not choose the narratives easily, and there are many other stories that could have been told. Some aspects of apple production may have fit more comfortably in the more traditional realm of sociology, having to do with labor, gender, or politics. Those stories are not the ones that are appropriate for me to tell, because they fall outside of my interest areas and expertise. I do not have the theoretical background to see these aspects of production as lucidly. I hope that this dissertation can aid those stories by offering some complementary or contradictory object to bump against. In an effort to alleviate the guilt of imperfection, I have listed the untold stories and research shortcomings below, perfectly aware that these are, like the dissertation itself, partial visions.

Untold Stories

When I started my research, growers were talking about clubs, and clubs caught my interest because I was interested in the role of biology in new organizational forms and they seemed like the perfect case to do so. When I got into doing the research, several growers told me that the most important question they faced was around labor. Many lamented that it was impossible to secure a labor supply for things like pruning and harvesting, and the increasingly hostile policing of undocumented workers was additionally stressful. During the last meeting I

attended of the International Fruit Tree Association, the CEO of US Apple announced that they would be organizing a task force to lobby the government to provide legal status for all the undocumented workers, and to develop a better guest worker program. At a previous meeting I had seen a presentation by the old president of US Apple, who mentioned that he had switched his support from Republican to Democrat over labor issues. The growers I spoke to were extremely worried about being raided by immigration officers. Even though they checked their workers paperwork, and would not be financially penalized if they had hired someone under forged documents, several growers suggested it would be demoralizing for their employees, hurt their chances of securing a labor force the following year, and be upsetting for them. Growers also mentioned that they tried to employ the same people every year for seasonal work like pruning and harvesting, but in years where they have significant crop failure, they will create as much work as possible so that they do not lose their annual workforce. Certainly, this was a big issue during the year when I did my research, when many orchards in the Midwest lost 90% of their crop.

The year that I did my research, the weather warmed up early and the trees went to blossom. Then it cooled to its normal spring temperatures including several cold freezes. The result was massive crop losses in the Midwest. The practices that growers employed to manage the weather was fascinating. Several had wind machines on their orchards that resembled a giant fan that would push pockets of warm air hovering down into the orchard, but each of these cost about forty thousand dollars. One grower in Michigan was famed for renting a helicopter and

flying it above the orchard, pushing the air down. One grower had burned hay bales around the edge of the orchard, and another tried an old trick of spraying molasses. In general, the technologies people used to manage the weather were fascinating. The man who was rumored to use the helicopter, for example, had a larger crop than many others in the region. The price of apples in the area was remarkably high, and as a result, the man who rented the helicopter did quire well. Those that had wind machines faired better than those that did not, and they received significant economic benefits as a result. Weather has varying economic affects on growers, and it would be useful to look at how these events lead some growers to expand and others to collapse.

Similarly, growers talked about climate change to me, and when I went to meetings there were often significant blocks of time devoted to climate change. In the last IFTA meeting I attended, there was an afternoon focused on climate change. During one presentation, a speaker was talking about climate patterns, and would introduce ideas with qualifiers like, "whether you believe climate change is human induced or not…" A grower in the back raised her hand and asked "you keep saying things like, 'whether you believe it's human induced or not.' Are you saying it that way because we're farmers? As an expert, you must have a professional opinion about whether it's human induced." The speaker agreed that he had changed his language and that he believed climate change was human induced. While a few farmers I spoke to were vehemently against the notion of climate change as government propaganda, the majority were clearly thinking about climate change,

and even applying it to how they were planning their orchards and thinking about the future.

Another notable absence from the dissertation papers is a discussion of gender. Had I chosen to do a more traditional dissertation format, I would have spent considerable time during my methods section discussing the role that my gender played in the research. Most of the people I interviewed were middle-aged men, but there were a few exceptions. Of the forty-four interviews I conducted, four were with women, and three were married couples in which both women and men were present. All of my research participants were white. I am a white woman with a slightly smaller-than-average stature, but I do look relatively young for someone completing a PhD, and I do find it difficult to pass as a serious academic. It gives me a research advantage in the sense that many of my participants did not expect me to know anything about farming, and were willing to explain things to me that were relatively basic. In some cases, I felt that my participants were trying to educate me, and not simply in farming but in the moral fabrics of life. Certainly this was the case when growers would ask me about my funding and then go to great lengths explaining how financially self-sufficient they had made their farm. In three cases growers explicitly discussed their conservative politics with me, and we would engage in a lively political dialogue occasionally laced with comments about my politics turning once I became older or more experienced in life. Any sort of moral disciplining put me on edge, but it was much easier to manage when the claims were explicit and I felt comfortable expressing my own position. In some cases, it seemed clear that the education I was receiving was paternalistic. One grower, Vincent, a

sixty-one year-old farmer and libertarian, explicitly remarked that it was "good to see a woman being educated," before telling me about the conspiracy of climate change and inquiring about my funding. "You are a lucky girl. Someone must be investing in you," he stated as I got out of my car on a beautiful fall day. At the end of the interview he asked whether my parents were supporting me. Or was I paying for myself? Or receiving grants? Whose grants? I mentioned I had a grant from the National Science Foundation. "So we're paying for you. The taxpayer is paying." "Well, yes. I've paid an awful lot more than the taxpayer, but yes. Sure hope I do a good job!" I awkwardly rambled, moving towards my car. After leaving in a cloud of relief, I realized that he had signed the wrong page of my consent form. Lamenting any possible conflict in the future, I turned around. The drive back was perhaps the most soul-sucking moment of my research, second only to the vehicular massacre of the ducklings.

Three Articles

The three articles I wrote about plants and clubs each answer the three research questions that drove the project from the very beginning:

What are clubs?

What do they accomplish?

Why have clubs emerged?

These questions were completely entangled in each other in reality, but they were aimed at exploring how biology and materials were tied to institutional organization. Each paper proposes a slightly different framework to answer these

questions, and together they could be seen to build a nuanced picture of people, plants, and the economy.

The first paper I wrote answered these questions by thinking about varieties. It integrates a biological and socio-economic approach to the greatest extent, and is intended to foreground the other two papers. In part, this is because varieties truly are a biological-social hybrid, and these named apples we buy in grocery stores cannot be thought of as a product of nature, culture, or human labor. Perhaps they could not even be considered a composite of the three, but a product of the relationship between them having been institutionalized in particular ways that invites reorganization and institutional change. Clubs could be seen as one form that reorganization and change could be taking.

Biology, technology, and landscapes are more foundational to the second paper, and it is situated within literature on actor-networks and the modernization of agriculture. The paper is the most theoretical, and tries to envision clubs within a narrative of biological wildness, economic rationality, technological innovation, and socially organized subjectivity. The paper argues that the technological innovations on orchard have been geared towards a more customized individualism, where the abstract economic actor, the farmer in this case, is expected to assemble the tools that are best suited to her economic position. While this project of technological betterment similarly feeds into modern capitalist ideals of individualism, it is a type of individualism, I argue, that is conducive to the types of collaborative economic relationships that underpin clubs and cooperatives, and has the potential to grant more agency to growers. However, I argue that the institutional structure around

markets and pricing also limit farming activities. In order for technologies to be liberating, they have to enable their users to also change the conditions of production more broadly.

In the third paper, I argue that club or managed varieties are part of a new ethic being institutionally introduced into apple production: varietal competition. This is a type of competition where varieties rather than farmers compete on a market. While there are groups of farmers, as well as packers and breeders, associated with the club variety, the price is negotiated for the variety, rather than being negotiated by each independent grower. This new way of participating in the apple industry advances the interests of actors participating in wholesale markets, who are invested in the maintenance of the markets, and who have recently struggled to stay afloat in more farm- and price-based forms of competition.

The three articles in this dissertation explore the relationship between biological materials and institutions by analyzing how they play out in the case of club apples. In doing so, they also offer some explanation for the emergence of club apples, and contribute to knowledge about the food, agriculture, and the biology of markets.

The Biology Of Markets: The Social Life of Varieties

Abstract

Apple varieties in the US have a tumultuous economic history. The recent economic boom following the stardom of Honeycrisp has brought memories of economic busts around old varieties such as Red Delicious and McIntosh. Growers are under pressure to plant popular varieties, but often, as the trees become productive, the variety's supply has started to flood the market and its popularity is beginning to wane. As one grower suggested to me, "every variety is destined to become non-profitable." This paper will discuss the emergence of club apples, or managed apple varieties, as a strategy to stabilize these boom and bust cycles while staying adaptive to the desires of the market. Club apples are patented apple varieties, often grown by members of a co-operative who plan the production and marketing of the apples. This paper will argue that varieties, as a biological and social construct, have shaped the development of the apple industry in ways that resist economic pressures to commodify the apple. The persistence of variety as an organizing feature in the industry has enabled growers to manage their competitive position by selecting what apples to produce. Club apples, or managed varieties, create more economic boundaries around varieties in ways that grant growers more control over the life of the apple. In this sense, the productive opportunities availed in material objects shape competition and the contours of economic markets.

Introduction

"It is remarkable how closely the history of the Apple-tree is connected with that of man"

Henry David Thoreau, *Wild Apples*

"Club" or "managed" apples are patented varieties that have exclusive growing and selling rights so that they only appear on orchards that can invest in their development and adhere to their cultivation guidelines. The SweeTango, for example, was recently developed by The University of Minnesota and cultivated by members of *The Next Big Thing Cooperative,* a group of forty-five growers spanning from Washington State to Nova Scotia. The cooperative was organized by a grower who received an exclusive license to the SweeTango variety. Other varieties, such as the Piñata on the West Coast and Red Prince from Central Canada, are similarly being patented and managed through exclusive licenses. Cornell and Washington State Universities have released several new varieties to be managed. Club apples are a new way of growing apples that is catching on.

Club apples raise important questions about the world in which we live, particularly questions about the relationship between economic markets, social organization, and biology. They are marketed more vigorously than other varieties and gain a higher market price; they are grown in organized clubs; they often have distinct grading standards. Each of these aspects of club apples is purposefully woven together as a response to perceptions of what's happening in the apple industry, the food industry,

and the economy more broadly. Most importantly, they are embedded in the biology of the apple and the material demands of apple cultivation.

Drawing on theoretical contributions from work on materialism (Callon 1986; Latour 2005; Swedberg 2008; Braun and Whatmore 2010), economic fields (Bourdieu 2005) and the new institutionalism (Fligstein 2001; Nee 2005), this paper will discuss the ways that the traits of the apple are mobilized for economic power. In particular, I will argue that the differences between varieties and their maintenance through grafting has shaped the apple industry and particularly the ways that growers compete with one another. It has generated the foundations for club apples, and in making this argument, I will be contributing to work that considers how materials and technology play a role in economic life (Swedberg 2008; Callon 2008) and how materials create publics and politics by generating an object through which people associate and disagree (Latour 2004; Dewey 1927). Materials are foundations of discourse and structure.

The participation of the apple in this process implies that economic institutions not only encourage particular logics to be reinforced through informal and formal rules, but material worlds can be made consistent with their contours. Marx can gave one of the clearest examples of the relationship between materials and the economy in his observation that the tools of production became crafted for particular, singular tasks, demanding the division of labor (1973: 460). On the other hand, institutions can be confronted with biological reality and the opportunities and constraints that exist in a material world. The tools of production that can be fashioned for the shop are limited by the malleability of metals and the flow of electricity. The metal of Weber's *stahlhartes Gehäuse* could be taken more seriously, so that the materials of capitalism could be

considered in our analytic approaches to the logic that get reproduced in the institutional architecture. The participation of apples in the institutional organization of the apple industry is an example of what I am calling *the biology of markets*.

Recently, materials have been receiving attention in economic sociology (Swedberg 2008, Callon 2008). Actor-network theory has suggested, among other things, that the types of activities that are performed are the function of an assemblage of heterogeneous materials, rather than the imagination and efforts of a single, human economic actor. Instead, tasks are accomplished by enrolling actants into a project, and through the relations of all the things networked together, action happens. It would happen differently if materials were removed from the network or new materials added. Economic action is no different. Beunza and Stark (2004), for example, have described the ways that the tools and layout of a Wall Street trading floor shape what kinds of decisions traders make and when they time their actions. They have tools to measure prices in stocks and futures, and they have ways to assess the accuracy of those tools, and these signals influence their actions. The tools, in other words, are actively engaged in the trading world and influence assessment and evaluation.

Tools influence actions and they are built purposefully. On the other hand, any material object is only partially seen. The essence of an object and what it can do partially escapes our vision. We are not all-seeing gods. Moreover, what is seen is context dependent. In other words, there is always the possibility of surprise or unpredictability. Sometimes these surprises are hazardous, like when environmental conditions cause nuclear power plants to behave in undesirable ways, or they can be fortuitous, like when mold was found to inhibit the development of bacteria in Alexander

Flemming's Petri dish, which he had accidently left uncovered. This biological surprise would lead to penicillin. While some objects are inert, and given a controlled environment they might be perfectly predictable, they live in an animate world and as a result, they are not lifeless.

The aliveness of technologies is relevant for thinking about the economy in a couple of ways. Firstly, biological materials require repeated attention and span across economic spaces, industries, and actors, and so they demand forms of cultural management that relate to their characteristics. Surgery rooms must be kept sterilized and there are rules about how to do so. Vines must be removed from the outside of old brick buildings so that the walls and insulation continue to function the way they were intended. Secondly, things that are alive change and adapt. Actor-network theory stresses that once an object is taken out of the network, it is no longer the same thing it was before, and its activities can fundamentally change when placed in another network. While a useful thought, it may miss the ways that biological materials become attached to networks and adapt to them, becoming dependent. Biological things can die and so engage in efforts for survival, and this makes them different from other materials.

The term *the biology of markets* denotes how biological materials, and their characteristics of aliveness, like growth, reproduction, and survival, shapes economic action and exchange. Agriculture is a particularly good case because plants play an explicit role, making the relationships between their biology and social relations clearer. For this paper and dissertation, I consider the ways that apple trees produce and reproduce shapes the apple industry. In the paper, I discuss particularly how varieties, as biological, social, and economic phenomena, influence the institutional structure of the

industry. The implications, however, are intended to reach beyond apples to add to conversations about other matters in the economy.

Substantively, this paper will also contribute to discourses on the relationship between food production and capitalist markets. With the emergence of organic and local food movements, many have challenged the degree to which significant change to food systems is possible without more significant change to broader economic systems (Guthman 2004a, 2004b; Allen and Kovach 2000). Critical research on the organic movement has effectively used a Marxist approach to demonstrate the ways that farmers are compelled towards accumulation and class distinctions are perpetuated through food consumption (Guthmann 2004a). Friedmann (2005) has suggested that we may be entering a new food regime, in which green consumer preferences play a greater role in organizing global food systems, while others have discussed the increased significance of food labelling (Raynolds 2000), grades and standards (Busch 2000, Busch and Bain 2004) and grower cooperatives (Guptill 2009). Looking at graziers as a case, Bell et at (2008) have described the ways that variability in production can be a benefit to farmers by expanding opportunities, to which ecological diversity is an integral foundation. This paper builds on the prospect that biological diversity can participate in that variability of practices, while also suggesting ways that those practices can translate to economic rules. Elsewhere, I have suggested that significant insights could be gained by considering the institutional arrangements that operate within modern food economies (Legun 2011).

In this paper I will propose a framework that will contribute to an institutional approach to food, but one that also emphasizes the importance of materials and the biological properties of crops. This follows other work that has looked at the participation

of crop characteristics in the organization of agriculture. Soluri (2005:104-127), for example, demonstrated how the requirements of banana cultivation and its susceptibility to Sigatoka disease shaped the emergence of the United Fruit Company as a vertically integrated monopoly. Similar research analyzing the historical relationship between a crop and political economy has been done on coffee (Paige 1998) and beans (Freidberg 2004). This paper will build on this work by considering how the materiality of apple production plays a part in changes unfolding in the industry. Apples also present a unique contribution because they differ from many other crops because varieties have consistently been significantly differentiated in the marketplace.

In this paper, I aim to illustrate that apples and apple trees participate in the economic organization of the apple industry, particularly through varieties. Apples and apple trees are shaped by economic institutions through a process of commodification. The process reflects more historic patterns in the industrialization of the agricultural landscape. Distinctly, I will argue that varietal differentiation also enables resistance to commoditification. Apples *also* shape the opportunities and constraints that growers face, and in doing so, materials can be seen to shape economic institutions. In particular, the cultural salience of variety, which is both a biological and social product, has created opportunities for the development of niche markets and branding. The recent changes in apple production and particularly the emergence of club or managed varieties may be indicative of broader changes, related to variety, happening in agriculture.

Apples can tell us something about the relationship between materials and institutions. This paper starts by outlining the literatures that this project weaves

together in its aims. Next, I will discuss the ways that apple varieties are a biological and economic institution. They are a product of economic and biological rules that have been threaded together. Thirdly, I will argue that commodification has altered commercial varieties by encouraging a single, idealized, generic vision of the apple to be realized in apple production. Lastly, I will argue that club varieties capitalize on those aspects of apples that resist this generalizing commodification: namely, they capitalize on the perseverance of varietals as an organizing category in both consumer and producer arenas. I will conclude by discussing some of the challenges that result from creating exclusive social boundaries around varieties.

Theoretical Background: Materials and Institutions

Weber suggested that Puritanism spawned the austere form of rationality that would become the foundation of modern capitalism, in which technical and economic calculations are the foundations of survival (Weber 2004). While scholars have translated and interpreted Weber's *stahlhartes gehause* as the "iron cage" of capitalism, others have suggested that the structure may be more dynamic and malleable, and might be better characterized as a complex of *institutions* that actors bump up against and alter with their actions. Nee (2005: 55) suggests that an institution is "a dominant system of informal and formal elements - shared beliefs, conventions, norms, and rules – which actors orient their actions to when they pursue their interests." This perspective advocates a context-bound model of economic choice, in which an actor may be moving through a field of rules that will

inform what he or she sees as opportunities and considers reasonable decisions. The club apple, in this model, is a type of action that may alter existing institutions, and redefine the opportunities and constraints that other orchardists may face in the future. As a relatively new type of activity or project, its emergence could be seen as an attempt to reconfigure the world in which people make decisions about apple production.

Maintaining and altering institutions is political, because those institutions privilege particular actions and behaviors. The institutionalists of sociology emphasize that they are not value-neutral nor are they shaped by the momentum of efficiency. Fligstein (2001) has suggested that actors in a market often try to maintain existing institutions because they have invested time and capital based on their structure, while those who hold a market advantage, and therefore economic power, will try to maintain existing market logics. When there is institutional change, it is because particular actors want to redefine the rules, or the costs and the benefits that exist in an economic market so that it privileges their own economic, political or cultural positions. Bourdieu (2005) similarly discusses how the formal and informal rules of an economic field determine the ways in which players can maintain or alter their position, relative to other economic players. Changing the rules does not affect everyone the same way or factor into some rational accounting. Instead, changing the rules is advancing a particular view of how the game should be played. Club apples should be no exception. Their emergence says something about what the apple industry is like, and what the apple industry should be like.

What is often missing from institutionalism is an explicit consideration of how these institutions or economic fields are grounded in places and things. Fligstein (2001) alludes to this with the title of his book, the *Architecture of Markets*, likening the economy to a building, while Boudieu's (2005) description of "fields" lends itself nicely to images of a sports field or another spatial arena. Yet there has been little real engagement with how places and material things play a role in the development of economic institutions. Swedberg (2008) suggests that the reason for this absence relates to the rejection of home economics from mainstream economic analysis. Home production and reproduction would be the arena in which objects would be used and consumed, where their functions, placement, and management would be considered an important aspect of economic life. The abstract, rational, predictable character, *homo economicus*, is distinctly public, habituating the spectral disemboddied spaces of pure interaction and exchange.

To some degree, this absence of materials has been remedied by a growing attention to the ways that materials and technologies play a role in all forms of action (Latour 2005; Haraway 1991), including economic action (Callon 2008; Zelizer 2007). The argument, in line with some older themes in pragmatism, is that economic actions are performed, and that performance happens in time and space and with the use of particular discursive and material resources. Making and shaping those resources that are invariably reproduced and shared among actors also shapes the economy, because it shapes what people do and what actions they can perform.

Thevenot (2001) uses a road to exemplify the ways that materials have behavioral and economic implications. While the building of a road can be the site of moral contest precisely because of the anticipated outcomes, once it's built, it's stable and reliable and taken for granted. It disappears into the background assumptions of everyday life, but still participates in the decision-making around a task and the facility with which an action can be undertaken, so that it's placement and the cities it connects, and the intersections it hits, have broader implications beyond the moment it was imaged. The basic argument Thevenot proposes makes economic life seem a little closer to the home life Swedberg (2008) describes. The environments of production are equally enveloped in the political and cultural organization of space and consumption of technological goods. Just as the home is organized around cultural interests and tasks, technologies would be developed with privileged economic actions in mind. In other words, the institutional contexts of an industry would be reflected in the development and dispersal of technologies.

With the increased marketization of universities (Klienman 2007), the traditional arbiters of technologies for some broader public interest, the coupling of innovation and markets only becomes tighter (Bermand 2008). On the other hand, productive technologies are shared and encourage similar economic performances across spaces and through time. This endurance of materials beyond the individual or any ephemeral use by *homo economicus* is what makes them so problematic. It is along these lines that materials create publics by providing a platform for anonymous association through an external object (Braun and Whatmore 2010; Dewey 1927). Even if the rules guiding action change, change may be limited by the

materials cultivated for particular productive purposes, and by the properties that they have independently of the human manipulation.

In short, work around institutions and materials both suggest that there is a politically crafted world that coordinates economic action, and there are ways that economic rules and materials relate. I will focus particularly on the ways that biological materials shape the economy, and not just as a repository of economic purpose but with properties that precede those purposes and perhaps inspire them. In other words, this paper will be unfolding as though the iron cage of capitalism that Weber described was not entirely metaphorical. After all, the idea of the 'iron cage' followed a vivid description of the empire of metal machinery built for industrialization. The machinery may have been a product of politics and a protestant ethic, but it was preceded by the existence, availability, and properties of metals.

Along similar lines, this paper on the apple industry will explore how those relationships between materials and institutions interact and relate to each other. Biological materials have a more overtly non-human productive capacity that needs to be harnessed. Unlike metals or plastics that could seemingly be molded to any project, plants are propelled by seemingly independent interests. I say seemingly because research has also discussed how metal, for example, can also be characterized as a complex organic material with something of an internal life (Barry 2008). It can behave in unpredictable ways. The wildness of plants is perhaps more overtly recognized, but they also have an interest in survival and reproduction that makes them resistant to change. Living things cannot be shaped and neglected,

but require ongoing attention and manipulation. Plants must be cultivated while other goods can be manufactured.

This paper will describe both how institutions have influenced the shape of plant materials in the industry through the commodification of apple. *Commodity apples*, as growers refer to them, are low-price apples that all look the same, because despite the variety, they have been selected for the same standardized characteristics. The use of commodification in this paper refers specifically to processes whereby objects on a market are produced en masse to maximize sales, based on an abstract calculation of consumer preference. Those objects are ultimately low-cost and designed to appeal to the broadest consumer audience possible. I will also discuss how varietal differentiation and plant reproduction has shaped the development of clubs, and in this sense, how materials shape institutions. The ways in which plants create opportunities and constraints for action, and in turn, the development of economic institutions, is how I will be exploring *the biology of markets.* The first section will introduce the biological and social development of apples and apple trees in the industry. Next, I will discuss how commodity apples were created through supply chains and grading standards. Finally, I will suggest that despite commodification, apples have a natural differentiation between varieties that has remained salient in the marketplace, and this differentiation enables a type of branding and social closure that growers can capitalize on. The biology of apples shapes the economy, and in this sense, apples maintain a space for more economic agency and diversity among growers.

Methods

Research for this project began in 2009 with observations at a regional conference for apple growers. Over the next three years, I read industry magazines, attended two more local workshops, and conducted a pilot study with four growers. Over that time, the project shifted from one focused on organic apple production to one focused on "club apples" or "managed varieties." My first real encounter with clubs was at a spray workshop in 2010, where I overheard a conversation between participants that went something like: "those apples look fantastic. What are they?" "They're Ambrosia. They're a club apple. We can't grow them." "Oh, drat." I was intrigued, and my interest grew after casual conversations with growers and extension agents suggested that these clubs were meaningful and controversial for a range of industry actors.

I began interviews with growers in January 2012 and finished by January 2013. I interviewed 37 growers, 19 of which grew a club or managed variety. Of the growers, 6 also ran substantial packing lines that would also pack and market apples for other growers. I asked growers a range of relatively open-ended questions about how they sold their apples and how they grew their apples. I focused particularly on the explanations for why they engaged in particular practices as a way for understanding the materials and institutional architecture of the apple producing world. I also interviewed two breeders, two marketers who worked for large packing houses, a nursery representative, and an extension agent. I attended meetings for a range of regional and national industry associations, including USApple and the International Fruit Tree Association.

Through my interviews and observations, I tried to generate a picture of the economic and ecological world of apple production, and particularly those moments where plants and markets were being discursively woven together in some way. The data for this paper were largely generated through questions about the different relationships in the marketplace and how growers were managing the orchard. I also asked questions about the varieties they were growing and managed varieties.

The research was conducted in Minnesota, Wisconsin, Michigan and Ohio. These states comprise the Midwest apple-producing region. I chose to focus on the Midwest in part because of the relatively small size of the apple industry compared to Washington State, which has dominated apple production since the 1980s (See Figure 1). Farm sizes are also considerably smaller in the Midwest (See Figure 2). On the other hand, there is a long history of orcharding in the region. Because of the reduced sizes of the average farm, paired with the lengthy production history, I speculated that the economic institutions may be less rigid and markets more varied, making those institutions more contestable and problematic. The Midwest is also the home of a managed variety that has been controversial, meaning that many growers were able to talk about their orchards in relation to the clubs.

method

Figure 1: Value of U.S. apple production, by State, 1980-2009 (by 1,000 dollars), total utilized production

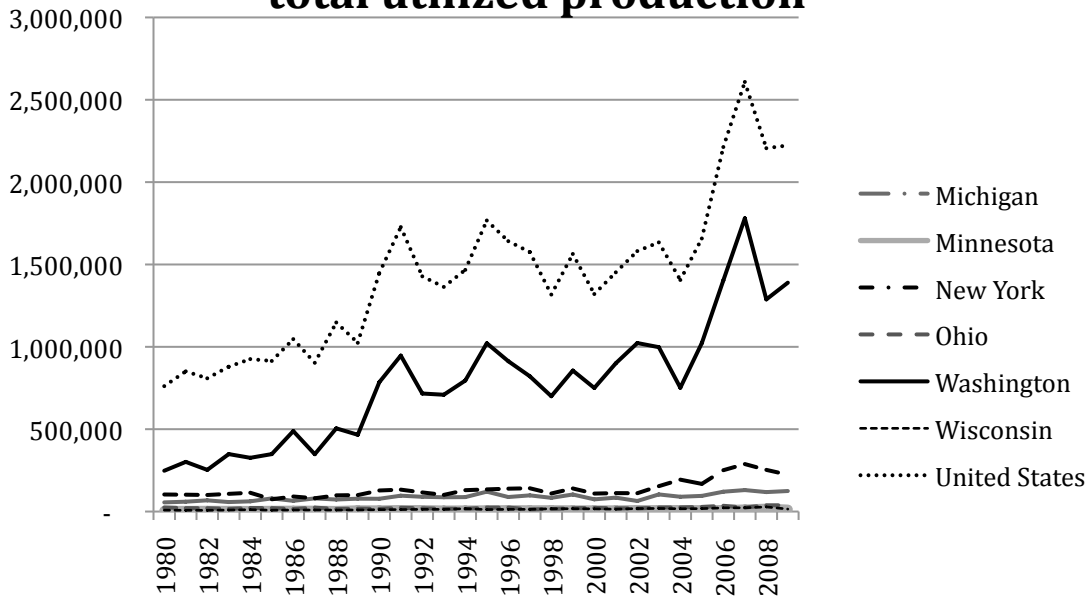
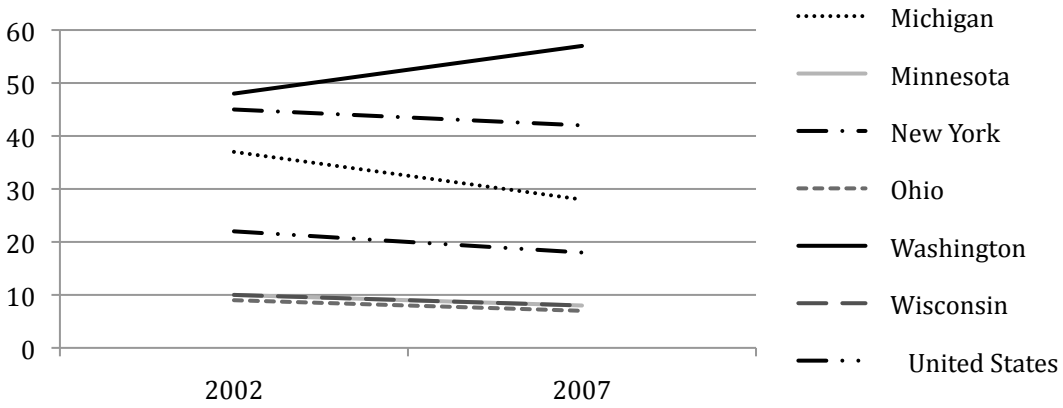


Figure 2: Average farm size (total apple acres/farms with bearing acres)



Source: US National Agriculture Statistics Service

Apple Varieties

The modern apple is truly the fruit of an arboreal Frankenstein. All common eating varieties of apples are reproduced by attaching shoots of a parent tree onto tree roots, called rootstocks, both of which have been bred purposefully to have particular characteristics. It is almost impossible to grow an edible apple from a planted seed. Yet, many common varieties are from chance seedlings. They sprung up randomly without seeds being intentionally planted. The McIntosh, for example, was discovered in 1811 by John McIntosh in Ontario, who found it while clearing land for his farm. The Granny Smith is from New South Wales in Australia, and was found by Maria Ann Smith in 1868 and cultivated. The first Red Delicious tree grew in Iowa, and was found in 1880 by a farmer named Jesse Hiatt, before he sold the variety to one of the first major North American nurseries. All McIntosh, Granny Smith, and Red Delicious apples are direct descendents of the original tree because they are reproduced clonally. If you planted the seeds of a Red Delicious, a Red Delicious apple would not grow on its branches, but instead something quite random and probably inedible. One grower described new apple trees as similar to children, in that their characteristics are very different from their parents and it's almost impossible to predict what they will look like and how they will behave. In short, an apple variety is not a naturally occurring phenomenon, in any way. It is a product of grafting technologies and the social concept of a variety. Without grafting, every apple tree that exists would produce different apples, and a large portion of them would be unsuitable for fresh eating.

Varieties have been reproduced through grafting for a long time, and all commercial eating apples come from trees that were grafted. Domestic apples originated in forests in what is now called Khazakstan, and grafting may have started as early as 3800 years ago in Mesopotamia (Harris et al 2002, citing Dalley). Recent research has suggested that apples had a variety of wild genetic contributors, including the European crabapple (Cornille et al. 2010). Moreover, while there may be a reduction in the number of varieties we see, and certainly the domestication process has streamlined the characteristics of apples we are commonly see on the market, Cornille and her colleagues (2010) find that domestication has actually not eroded the genetic diversity of apples. In part, they suggest, this maintenance of diversity is because domestic apples genetically resemble wild apples so closely. Because domestication involves cloning existing trees, and trees have a relatively long lifespan, the types of changes that have happened over time have not been as significant as one might expect. The genetic trajectory of apple history has not pulled apples too far from their wild roots or reduced their gene pool. The result is that within apples there is still a lot of diversity and very distinct flavors and textures that can be produced. Apples have not experienced the same genetic domestication bottleneck that is often seen in annual crops that are grown from seed.

In some ways, the need to graft and clonally reproduce apple trees makes the organization of trees into varieties seem organic, as there's a very direct parental line, clearly traceable. On the other hand, the distinction is highly social. The threads linking one line of trees become seemingly entangled in others, as Harris, Robinson

and Juniper (2002) illustrate in their attempt to differentiate varieties based on genes. It is not easy to genetically differentiate between types of trees. The distinction that *is* made is highly discursive. Even as genetic research has blossomed, the differences between varieties can be difficult to pin down and largely a social and legal matter, rather than a scientific one, and constitutes what Latour would call a *matter of concern* (2004). Varieties create publics by enlisting actors in an agreement that they have been sensibly identified and defined as such. This is most evident in the patenting process for apples, whereby variety owners submit paperwork listing the distinct qualities of the apple trees and the fruit. Patents enable breeders and those that discover a new variety to officially mark its boundaries and lay claim to those characteristics. The act was greatly influenced by Luther Burbank, an apple breeder, and Stark Nurseries, the company responsible for purchasing the Red Delicious from Jesse Hiatt (Fowler 2000). There is no test that is done on the genes of the apple. A grower, Ted, who had recently filed for a plant patent explained it to me:

> "There's a bunch of information that the US plant patent office needs. There's no real form or anything, just descriptions of everything from the leaves to the blossoms, the apples, the stem. Anything you can measure they want a measurement of. There's a color code and so you have to match up the color – the flesh is blah blah white. The skin is blah blah blah red with an undertone of blah blah blah yellowish, or you know. It's a very technical document. "

Here, Ted is almost mocking the document for its combination of rigor and awkwardness. All of these measurements are supposed to provide some sort of physical definition around the variety – a boundary that identifies the plant as a legitimate whole. Bill, a university breeder, discussed the problem of socially creating a variety. "The requirements to get a patent, are, I forget the exact wording, but basically it has to do with a new, unique, and distinct variety, and that doesn't mean slightly different. Of course—that line—what is truly unique?" In the United States, the onus would fall on a dissenter to demonstrate that a variety is not distinct. A patent holder would have to legally challenge a violator, in which case it seems futile to consult the patent. There are many trees that have very similar characteristics, and to distinguish between them would certainly be a case of a judgment. If a patent were violated, it would likely be on the grounds that someone was selling apples for a tree they had no rights to, and this would clearly be more straightforward. The legal use of the patent to secure rights may be less important than the social legitimation of a variety that is associated with the document. A *variety* is the product of a social contract about what constitutes a new and distinct plant, and it often is not a clearly marked threshold of sameness that must be surpassed. On the other hand, even if a patent recognizes an apple tree as distinct, the crux of that distinction gets born in the market. While varieties are a social product, they are also an economic product because people distinguish between apple varieties in the market and award them different values.

Varieties have different market values. Many of the growers I spoke to referred to the price of an apple as largely dependent on the variety, and the supply

and demand associated with that variety. At the USApple meetings I attended in Chicago in August of 2012, one of the presentations forecasting the upcoming apple market focused on the economic differences between varieties, displaying graphs with different lines marking the divergent price histories. Braeburns, they suggested, were decreasing in price and profitability, while the demand for Honeycrisp was only increasing. Get out of Braeburn, and jump on the Honeycrisp wagon. Similarly, many growers planned their orchards based on the market price of varieties and whether they viewed the variety on a price and demand upslope or a whether they were approaching oversupply.

The economic definition of varieties was clearly tied to the social definition of the apple and biological characteristics like color, texture, and flavor. The price of an apple would become so low that the growers would have to completely remove it from their orchard, or they would be so invested in that variety that they would lose their orchard. After all, trees do not reach production for at least three years, so the market for a variety can change quite significantly between the time of the investment and the time of the sale.

There are debates about the characteristics of the variety and how these characteristics might be inconsistent. Some apples would have a different texture, or a different sweetness, or just overall, a different flavor, but they would all be sold as one variety. Some growers lamented that this would ruin the market by making the consumer confused. In other cases, one variety would begin to look to much like another variety. For example, one grower suggested that the red Gala apples looked

too much like Red Delicious, and the result would be a general dissatisfaction with apples overall.

Varieties are biologically, socially, and economically defined. The genetic diversity among different apples means that there are opportunities to distinguish between varieties, and yet, that distinction is as much a social agreement as an innate biological one. In order for apples clonally reproduced from one apple tree, that variety must be named and its connection to other trees recognized. Varieties are also an economic construction used to determine the different values of apples in the marketplace. On the other hand, the economic distinction between varieties is reduced through the commodification of apples, which I will discuss in the following section.

Commodity apples

While varieties are treated as distinct in the market, they also follow the same economic trajectories and ultimately become what growers call *commodity apples*. These apples may begin as popular varieties with high demand, but ultimately become economically indistinguishable from others as their supply expands and their popularity wanes. These apples may have different names, but they have the same price and become a sort of generic, prototypical apple, and are only profitable when produced in large quantities because they receive such a narrow margin. Growers in the Midwest have a smaller farm size, on average, and more climatic constraints than Washington State, so producing commodity apples for wholesale is particularly challenging. Many growers relayed this boom and bust narrative when describing how they made decisions around what to plant and how

they tried to stay economically afloat, but one of the key features of commodity apples is the degree to which the power of variety is dissolved. Jeff, for example, consistently referred to *commodity apples* in how he positioned himself as a grower. I asked him, "What's a commodity apple?" He replied in a way that highlighted the low price, placelessness, and standardized apple-like qualities that are valued in the market:

> "I would say a commodity apple is one that's kind of a base-price apple in the marketplace that is grown a multitude of places. A lot of times it's been around a while. Red Delicious, I would say, is a classic commodity apple. It's grown everywhere and marketed everywhere and if you ask a person "is this an apple" they would go, "oh yes." I mean it's very recognizable, but it doesn't have any flare to it that separates it from the pack. It's just a general apple. You'll see them in the grocery store; a whole range of three/four varieties all priced the same. They're the apples that go on sale when apples are on sale and you'll see Fuji and Jonagold and Gala, Red Delicious, Goldens and Grannys, all for 99 cents a pound this week. And those are, to me, commodity apples. Not that commodity apples are bad, but you better have an apple that you can produce a lot, and get a high pack out, to make money on a commodity apple. Because pricing is lower, so you have to make up the lower pricing with quantity. You've got to have quantity at the farm and you've got to have quantity to pack out.

Commodity apples are plain and fit better into the ideal-typical category of *apple* than the specific category of *variety*. They have the qualities that fit most generally with the cultural construct of what we mean by an apple, and these general characteristics become more salient to the economic differentiation of apples from other fruit than between varieties. The apples become priced based on the scale of where they fit in relation to the ideal apple. The pack out that Jeff refers to is the proportion of apples that meet higher grading standards, and those standards sort all varieties of apples along the same continuum of ideals. Good apples are red and large.

Apple grades have historically sorted apples entirely along size and color dimensions and continue to do so. Modern packing technologies weigh and take up to 25 pictures of each apple, scanning the surface for the amount of redness. Generally, larger, redder apples fetch a higher market price. More recently, those packing technologies have been developed to also scan inside the apple for imperfections and measure the internal density of the carbohydrates in the apple. Larger, redder, sweeter, firmer apples are valued more, and the greater proportion of apples that creep closer to this picture of apple perfection, the more money the grower receives. In short, while a social and biological distinction between varieties remains, the market tends towards erasing those distinctions through the institution of grading standards.

The growth of the supermarket culture in concert with grading standards has made the necessity to produce this idealized apple even stronger, and this pressure can be seen in the proliferation of red sports or red strains. Red sports happen when

a tree's limb mutates slightly so that the apples that it produces are generally redder. A scion, or new shoot is taken from the limb and grafted, and the resulting tree is a redder version of the original variety. It can be patented and sold to growers to make it easier for them to produce higher proportions of redder apples and meet the higher grading standards. Milling over any nursery catalogue reveals a wide selection of freshly patented redder version of old varieties, and the most common narrative around the plight of the ever-redder apple is in the Red Delicious. "Red Delicious," Bill, an apple breeder explains "is my least favorite apple in the world. It's the result of over 200 mutations that have been discovered. It was originally found on a broken-down farm in Iowa and it was probably about 30% red at the time and now 200 mutations later, you can't find a part of that apple that's not red. It doesn't mean it's not ripe, but it's red." Grant, a grower involved with a managed variety, made a similar claim:

> "The trading partners said make them redder, and make them so they don't show bruises. They didn't say anything about the flavor. The modern Washington Red Delicious apples, most of them, are never little green apples. They start out as red apples after the blossom forms. And they're grass green inside so you could pick them months ahead of time. Well, not months, but the internal maturity has no relationship whatsoever to do with eating quality. So that is happening with Gala, and we now have all of these red strains of Gala which are all inferior in terms of eating quality."

It's interesting and telling that the prototypical commodity apple that Jeff identified earlier, the Red Delicious, is also a central actor in the narrative of redness. Growers in Washington cite the cycle of strains as a reason for the collapse of the industry. In 2000, Congress signed the biggest apple industry bailout bill in history (Egan 2010). In a 2000 *New York Times* article documenting the collapse, Doyle Flemming placed blame in the industry. "For almost 50 years," he suggested, "we've been cramming down the consumer's throat a red apple with ever thicker skin, sometimes mushy, sometimes very good if done right, but a product that was bred for color and size and not for taste." The increasing redness of apples is propelled by patent systems that enable varieties to be re-patented, basically, through plant mutations. Bill, an apple breeder, explained to me how mutations for redness occur and are patented, and how this system relates to the decline of the red delicious:

> As plants grow they grow as our bodies, the same way. Cells divide, they replicate themselves, they split in half and form pairs, and in the process, maybe one in a million or a billion times that replication goes slightly awry, and that's a mutation. It's naturally occurring. Nothing scary about it. And most of those mutations affect things that we never even see. The enzyme that turns on the leaf drop occurs slightly differently. You'd never even see it. But a tiny percentage of those mutations are something that we happen to see, and in the case of apples, the ones that people look for is something that turns the fruit redder… So what happens then is that growers will see an apple that's

> redder than the rest of the limb, the rest of the orchard, you know, that's a mutation. In the perfect world, that's a mutation. They then reproduce that mutation clonally and basically have a red version of that. So legally then, what's possible? Well, in the US, if you find a red version of an apple that's been patented, that's considered a new variety; a new and distinct variety and so you can patent that. You can have Honeycrisp and Red Honeycrisp. Of course if you own the trademark name, you wouldn't let someone use the name Honeycrisp, they'd have to come up with some other name. At any rate, they can apply for a plant patent and have that as a new and distinct variety.

Once a red strain of a variety has been developed it can spread fairly rapidly throughout commercial plantings because the growers that are still relying on a less coloring strain will be at a disadvantage. All of the commercial growers I spoke to mentioned constantly replanting the orchard, and much of the replanting was geared towards adopting these new, more marketable strains.

The introduction of red strains propels the commodification of apples forward because it causes varieties to increasingly look the same as other apples. It also places more pressure on growers to run along a production treadmill of continuous replanting, while affirming the legitimacy of the standards and retail markets. The growers take all of the risk, but the standards are generally outside of their control. Russell, a midsized grower described to me how standards for color in a variety can influence participation in a market:

> "Jonagold is originally a green-yellow apple with an orange cheek, and the breeders got hold of it and turned it into a red apple, and so now… I told you we had Jonagold and we took them all out. I had two or three varieties of Jonagold and they were the best possible apples, but it was at a time when Jonagold was going redder and redder, and when I shipped them to the packing house, they went "well, what did you do with the red ones? Did you take all those for yourself?" So now, to hell with them. That's my marketing angle. So that comes all the way back to the very first question, how do you make it as an apple grower. We have a lot of interest in direct marketing."

The only way to avoid the pressure to replant red strains may be to dodge the dominant supply chain altogether. In the apple industry, and particularly in mainstream supply chains where apples pass through a packing line, destined for large retailers, there is a pressure to create sameness across apple varieties.

The standards that organize the apples into value categories are the same across varieties, even though those characteristics are partly what make different varieties unique. These are the characteristics that get written on patents to identify a variety as distinct, and yet the apples that grace the bins of the produce aisle look increasingly similar in terms of size and coloring. As a variety becomes popular, it slowly becomes valued at the same price as other apples. *It also increasingly looks the same* as other apples, as it becomes redder and is thinned to be the same large size. The result is a dissolution of variety in a way that is an expression of market

power, and at the same time a challenge to the negotiating power of growers, who use varieties to manage their position in the market and buffer against competition.

The Maintenance of Variety

Most varieties exist on a scale of commodification depending on where they are in their supply-demand curve, so growers stay profitable through replanting new varieties. Many growers I spoke to noted that the way to stay profitable is to choose varieties that are on the upslope of a demand curve, and constantly update the orchard with these types of varieties. Several growers told me that at any given time, at least a fifth of their orchard would be in transition, while another quoted a number closer to five or ten percent. Staying profitable meant a determined and ruthless approach to removing varieties and planting new ones. The varieties they would remove would be those that had become commodity apples, and the ones that would be planted were not. George, a grower who also worked as a consultant, pointed to a large section of his orchard:

> "We had Red Delicious in here, and we had some Empires, and we had some strains of Jonagold that weren't very high coloring. As the trees were about 6 years old, we came to the realization that the returns per bin were going to be about $100 per bin. Well, that's not cutting it. They were 6 years old. They were beautiful young trees, all just coming into full production. We pulled them out and replanted with Honeycrisp because we were missing the boat."

The Honeycrisp apple was the prototypical "premium apple" in my interviews. It had been increasing in price for the two decades, but had only recently

reached the levels of popularity and fame that it was currently experiencing. Apart from its high price, growers in the Midwest referred to the Honeycrisp as being a significant variety for several reasons, many of which had to do with its biological traits. One of most important characteristics of the variety is its preference for a particular Midwest climate. The apple does well with cold nights, which makes it less suitable for Eastern Washington than Minnesota, Wisconsin, or Michigan. While the large apple-producing region in Washington had certainly begun to grow the Honeycrisp, many of the growers were sure that they would be unable to produce a fruit with the same flavor and eating quality as the Midwest. The result would be a protective barrier against competition, particularly in the Midwest where the apple had established a regional fame and following. Of particular importance to the celebrity of Honeyrcrisp is the texture of the fruit that is claimed to be significantly different from other apples. The apple has larger cells that make it juicier when eaten (Mann et al. 2005). Some growers argued that the new and unique texture of Honeycrisp would make its distinction from other varieties persist for longer in the marketplace.

The trees are also particularly demanding and labor intensive in ways that differentiate them from other varieties and make them resistant to large plantings. Growers, however, had very different opinions about the degree to which the growing quirks were significant and would prevent Washington from taking over the market. They have a calcium deficiency that makes them particularly prone bitter pit, where the flesh inside turns brown and dark sports appear on the surface of the apple. Also, due to their relatively thin skin and woody stems, growers often

remove the stems with clippers immediately after picking them from the tree and before placing them in the picking bins. If the stem is not removed, when they are all placed together, the stems of the apples will puncture the skin of other apples and render them unsuitable for fresh eating. Most of the growers I spoke to who grew Honeycrisp mentioned that they engaged in the stem removal practice, that it added significant additional labor costs, and that it was the only apple that required the procedure. The trees also tend to produce fewer apples per acre. Despite the setbacks, growers continue to plant the Honeycrisp because the price is high and makes the extra work worthwhile, but it may be increasingly less worthwhile for large operators who may have less interest in the specialized additional labor. Some growers I interviewed said that even if the price were lower, they would continue to grow the variety because it was so important to consumers and was an integral part of Midwest apple culture. Growers describe it as a saving grace for regional orchards. "For us, for all the orchards around here" Ben explained, "if it wasn't for Honeycrisp and then for people's desire for regional-seasonal fruit, most of the orchards would have gone out of business. I have no doubt about that." The Honeycrisp is considered to be an apple that significantly changed apple production.

The Honeycrisp is just a contemporary example of the persistent significance of varieties. Other varieties, such as the Gala or Zestar, fall somewhere between the premium apples and the cheap commodity apples in my interviews. Growers received a higher price and considered them a more popular apple than the Red Delicious or McIntosh. To some degree, the level of distinction an apple has depends on the time it has spent on the market. Even though different varieties may become

more similar with market pressure, the fact that the supply and demand curves remain different for each variety gives growers an opportunity to leap away from simple large scale commodity production, while still being able to participate in a wholesale market. The result is constantly replanting with new varieties to try to stay ahead of the curve, and plant while the variety remains profitable. There is a constant cycle of predicting what will be the popular new varieties, and the growers I spoke to in the Midwest suggested that removing old varieties and replanting new varieties every year was part of being an engaged grower.

While growers are on a treadmill to continue to keep up with the trends, working with different varieties in the orchard also gives growers the ability to differentiate themselves from each other and experiment with new varieties. Many of the growers had a story about how they got involved with planting the Honeycrisp early. They were nervous given its testy behavior and lack of market experience at the time, but they were also proud of the variety and their association with it.

Apple varieties are still quite distinct and enable growers to participate more fully in the apple industry without becoming completely cornered into competitive commodity production, where they are all simply trying to race to the bottom in terms of price while increasing the production of larger, redder apples as much as possible. Instead, they can balance the risks and opportunities associated with different varieties, and plant the apples that do the best on their land and in the markets that they have better access to.

The Emergence of Club apples

The distinction between varieties grants leverage to growers. Those gaps between varieties create the space to move and innovate, in a way that would be less possible were those varieties more limited. If there were only red delicious, golden delicious, and granny smith apples, it would be much more difficult for Midwest growers to stay competitive when other regions like Washington State have a climatic advantage for low-cost large-scale production. Varieties prevent a race to the bottom by providing more options to consumers and growers, and the foundations for diverse kind of flavors and characteristics that growers can harness to be more suitable for their land. However, growers still have limited control over the profitability of varieties, and the lack of predictability and coordination provides challenges for growers.

Once an apple leaves the farm and the packing-house, it becomes anonymous, and in this sense, all varieties are destined to become a commodity. While the economic trajectory for each variety from high demand to oversupply is somewhat accepted, growers often lamented that the oversupply and low price caused cost cutting that compromised the quality of the apple, and the result would be that consumers would come to dislike the variety, and possibly apples more generally. Bad apples ruin the bunch. Once an apple has reached its peak demand, the pressure to produce larger, redder apples at a lower cost can exacerbate that downward price slope and growers can quickly become left with trees that are completely unprofitable. Paul, a grower who also ran a large packing line, explained the problematic economic nature of the economic life of varieties to me:

> "The problem is, we have tremendous horsepower to produce anything in the agricultural environment so if we're just looking at apples, there's huge horsepower to take anything and produce it to levels that are beyond the demand. The old model, the main flaw was that a good variety, if it was making money, would attract people to put it in to the point where the demand was not able to meet the supply. The supply was bigger than the demand. Every variety would go through that economic curve where, if you're on the front end of it, you made money. If you planted on the tail end, you're now in the over-producing line and so every variety of any quality typically was destined to become non-profitable… All of the investment of putting in a new variety always falls on the grower. It's a long term – you don't even get production for three years, four years, five years, so you're planting products in orchards that are, these days, in the 20,000 dollar an acre establishment costs and so you're putting in varieties that take that level of investment and you are going to be the one that suffers, in the end, if it is going to be a very successful variety."

If commodity apples are a reduction in the economic power of varietal distinction, clubs are a heightening of those distinctions in the marketplace to channel market power towards growers and variety owners. In doing so, they also gain some grasp on the booms and busts of variety by controlling the number of people growing the apples as well as having a more coordinated entrance on the market. The club apple licenses that were mentioned in my interviews mandated

that growers become part of a cooperative that would discuss and establish a price. They would also have conversations and varying agreements around the qualities of the apples and red strains. For example, one cooperative only sold a single grade of the apples, completely undercutting the mainstream grading systems. While that grade would be based on size and color, growers would control the parameters of the grade, and there would be no premium for redder apples within the category of saleable apples. Moreover, clubs often have a rule about red strains. For one club, the contract stipulates that any red strain becomes the property of the cooperative, whose members can decide whether to release the strain. Another leader in a club stated that they would decide what to do with a red strain should it appear, but they would be very resistant to its propagation. Overall, the clubs try to prevent the commodification processes normally associated with production by creating social boundaries around a variety, and using those existing social and biological differences between varieties to expand the economic distinctions.

Clubs are also associated with more aggressive marketing strategies that basically turn varieties into brands. Focusing on producing a consistent product tied to a group of producers with a set price is a way of generating a brand in which the variety is more coherent when it reaches the consumer and growers have more control over what that variety looks like. Grant, for example, described to me how managed varieties began and suggested that the branding would enable growers to gain more power in the marketplace:

> "Growers are going upside down right and left. Many of us in the industry… We developed the notion that what we really had to do was

> elevate ourselves beyond the commodity marketplace. We had to start to behave like brands. We had to see to it that we had the power of reaching through the retailer to the consumer to create true consumer brands and then try to bring some of that benefit back to the growers and also try to bring some of that benefit back to the people who were developing new varieties"

"Reaching through the retailer" is an expression of gaining more economic power by being more active at the point of sale. For Grant and other growers, that power is accomplished via the biological and social institution of variety.

The growth of club varieties has the potential to significantly change the industry, although it's unclear how extensively. There is no set limit on the number of varieties that can exist, given that varieties ripen at different times and the growth of diverse local markets could mean there is quite a lot of market space. Some suggest that larger retail markets will only stock one or two premium apples at once, creating more competition between clubs and the possible failure of some at the success of others. However, as new high-end retail stores are emerging to cater to the foodie culture, the number of varieties on their shelves are certainly quite expansive. The degree to which the market will bear new varieties is a site of significant contest among growers.

There is a risk that the development of clubs will introduce conflicts into what has been quite a collaborative environment. Some of these conflicts surfaced during my interviews. One of the problems growers cited in association with the clubs was that growers who do not have access will be at a competitive

disadvantage, and the premium varieties that they currently rely on could lose value. In general, few growers saw the club varieties as a real economic threat, but several mentioned that they saw the more exclusive varieties as an affront to grower camaraderie. In a non-club setting, growers would be invested in the success of varieties, regardless of who was growing them, and would benefit from the success of their neighbors, as previously discussed. Club varieties challenge this arrangement, because those who are unable to access the variety suddenly have an economic stake in its failure. "If someone asks for a SweeTango, I tell them to try the Honeycrisp or a Gala." A grower, Frank, said to me. "I say, don't waste your time with a SweeTango. Why would I want to market the SweeTango, when I can't grow it?" By the same token, there was some anxiety around the marketing of the SweeTango as a better version of the Honeycrisp. Given that the Honeycrisp was so pivotal to apple production in the Midwest, and given that growers were anxious about the oversupply of Honeycrisp, it was callous, they argued, for a new exclusive variety to disparage the apple and violate a code of cooperation and camaraderie.

While the emergence of managed varieties does run the risk of making the apple industry more divided, and divided between the haves and have-nots, growers have access to the resources that create new apple varieties, so there is nothing necessarily giving one group of growers an advantage over another. One of the newest managed varieties emerging in Ohio was the product of a program developed by growers after they gained access to a large selection of experimental trees. The growers organized the Midwest Apple Improvement Association, and growers would join by paying an annual $100 fee and planting some of the varieties

on their land. A variety with potential for commercial success was found, and it is being marketed through MAIA as a managed variety. It will be relatively easy for growers to access: they simply need to pay the annual fee to join the organization, and agree to price the apple at the same rate as the rest of the co-operative.

Discussion

While social closure around varieties exemplifies a classic example of the expansion of capital, I have tried to add depth and complexity to that narrative. Club varieties do not simply solidify the boundaries of property that already existed, they also reclaim the differences between varieties and capitalize on them. The socio-economic boundaries around varieties are, in a sense, overlapping with the socio-biological, so that materials can be managed and contained, which prevents a type of commodification that breaks those varietal boundaries down in the marketplace. They can help maintain the ecological diversity that Bell and his colleagues (2008) suggested could play such an important role in farming. These material differences between varieties provide an opportunity to make distinctions in the marketplace, and create social groups. Just as Latour (2006) discussed matters of concern, or Dewey (1927) referred to material publics, materials can provide an external object to organize disassociated people around. Materials can create publics, and perhaps *economic publics* as well. Each of these publics could, conceivably, have a slightly different institutional structure, just as the clubs I saw in my research had different rules and standards. By having different materials to organize around, and so many different varieties, as in the case of apples, growers can participate in more

economic publics and gain some choice over the institutional structures they choose to participate it, be they different forms of cooperatives for managed varieties, or more traditional commodity production.

Varieties put pressure against economic trends that collapse growers into a single, competitive group. On the other hand, when growers have such little control over the economic fate of the variety, they invariably have to change their plantings in response to the habits of the market. While growers who plant managed varieties will still have to replant, they have more control over the apple that arrives in supermarket bins and is presented to the consumer. This control, paired with the increased control associated with greater market options, suggests that managed varieties are an attempt to, at least partly, give more market power to growers.

Standards organized to apple size and redness are part of the institutional architecture of the industry. They are rules that are taken for granted, and shape the options that confront growers. They also exemplify the types of *conceptions of control,* to use Fligstein's (2001) term, that privileges actors further along the food chain and place growers in a position where they have less control over how they are represented through their product. Apples become valued along a single measure of how closely it approximates the idealized large, red apple. Technologies, including the development of new apple strains, continue to reflect the architecture of the commodity economy, so that those standards become reflected in the material world. Yet, varieties remain distinct and meaningful biologically and culturally, and provide the material foundations for new forms of organization.

The biology of the apple, and the resistance apples offer to the whims of the market, create opportunities for growers to have more control over their market position. While there are pressures to industrialize apple production by organizing it around the idealized large red apple, and a single scale of measurement with a range determined by a version of the perfect apple, the differences that exist biologically mean that new varieties will always confront the model of production perfection. They will always deviate from what the market is supposed to want. The biology of the apple plays a role in the shape of the market.

Conclusion

In this paper, I have tried to develop a picture of the material and economic environment that club or managed varieties respond to. I entered the project very critical of clubs, and remain wary. I found many reasons to be wary in my research. The expansion of property can be problematic because it has the potential to exclude some growers, and widen a gap between those that have access to a successful variety and those that do not. Creating social boundaries around productive things and solidifying those boundaries in property law is exclusive, hence the term, *clubs*. Yet, materials are inherently exclusive, which is what makes their contours so politically vibrant. By nature of their spatial and temporal presence in the world, access is never fully open. People are unable to access things whenever they want, however they want, and so in some ways, they are exclusive. In other words, the material foundations of our economic activities further challenge the notion that a market can ever be free. With global trading patterns and the mass production of goods, prices drop, access increases, that exclusivity seems to

diminish, and yet, it is impossible to overcome. Just because two people have the same productive good does not mean that they have equal access, because the usefulness of goods is highly related to other contextual factors. The benefits of a vehicle are very different depending on whether the owner has access to gas and roads to traverse.

What seem to be important questions around the social boundaries that are made around materials, and biological materials in particular, is how access determines the shape of things and what future opportunities and constraints they will carry forward, beyond the organizational structure. The more pressing question regarding exclusivity would be whether biological materials are being shaped by a small, privileged group of people. Those who control the production technologies also influence what the industry *is* and what it *does*. If the clubs cluster around varieties, and make distinctions between varieties more meaningful and powerful in the apple market, this probably changes what it means to be grower and what sorts of activities are possible. Finding those distinctive apples that are also commercially viable becomes a new task. In the context of *the biology of markets*, questions of exclusivity should be about social limits around defining and crafting the biological world in ways that mobilize and solidify economic power, which in turn, shapes how the industry unfolds in the future. The exclusivity associated with the propagation of terminator genes in corn, for example, is not only problematic because of the exclusivity of control over the property, but by the exclusivity with which some companies have had access to the alteration of corn and its behavior, while many

other industry actors do not. Importantly, these changes to corn have an impact on the practices of corn farming.

The diversity in apples is important. A difference between corn and apples to consider is that breeding for apples occurs naturally, all the time, as every apple can generate several new varieties and these are all notably diverse. The lack of genetically modified apples means that genes aren't patented, so different people, under different conditions, in different spaces, can create varieties. Clearly, breeding programs have an advantage due to their large stock of trees to work with and staff whose primary job is to observe and manage them, but new varieties are the spawn of well known parents that any orchard would have. On the other hand, the first genetically modified apple will be entering the US market soon, and the implications for variety access and production should be considered. With genetic modification, clubs would adopt a different meaning in the industry.

The shapes of materials influence economic life. The animate underpinnings of materials of things, either because they have some aspects of aliveness themselves or because they exist in a living world, is relevant to considering what opportunities and constraints confront economic actors. The ways that apple trees reproduce is an invitation for some types of human intervention, but it also provides resistance to a fully commodified apple. The same analysis could be applied to other materials that we would not necessarily identify as biological. For example, the various types of houses that are built to make use of local materials *and* respond to biological elements like grasses, trees, and termites could certainly shape how housing markets are organized and how actors within that market relate. In short,

the story of apples is one story of many in a broader narrative of *the biology of markets*.

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The Bionic Orchard: The role of Institutions on Technologically Mediated Economic Agencies

Abstract

The size and vigor of apple trees is controlled by the root systems, or rootstocks, that are used in grafting. Dwarfing rootstocks, that cause the tree to grow to a height of less than ten feet, have been around for at least 200 years, but they have only recently become popular in commercial orchards in the Midwest. Dwarfing rootstocks are a type of technology that allows growers to intervene in the tree in new ways, and create a more experimental landscape. Dwarfing rootstocks enable growers to develop a more customized orchard, where they can mold the tools that are being used to particularities of the farm. The development of these technologies has implications for the development of economic subjectivities. While technologies often rationalize and standardize economic activities, they also have the potential to expand opportunities, encourage creativity, and engender cooperation. However, the ways that technologies shape economic *agency* has much to do with the institutional structure in which they are embedded. The biology of the tree and the associated technologies may expand possible actions, but market institutions also shape how that expansion is realized in practice. Agency cannot be increased by the introduction of technology along, but through the ability to negotiate the rules that shape its use.

Introduction

In the spring of 2012, I had just finished an interview with a grower and he had offered to take me on a drive through the orchard. I wandered up to the black truck, and struggled to hoist myself up into the passenger seat. As we drove out in the orchard, I saw about an acre full of frail little whips, supported by a trellis. Their limbs were so thin they were vine-like and almost two-dimensional. He had only planted a year ago, and would be planting another block on a trellis soon. They would start producing apples the following year, which I found hard to believe given their current stage of development. As we moved through the orchard, we passed trees in different constellations and at various stages of development. Some were trellised and their upper branches reached eight feet from the ground. Some were a bushy, vibrant green, launching outwards a foot from the trellis. Others were less lively, and seemed to keep close to the wires. As we kept driving, we entered a block with freestanding trees, taller, with branches growing out in all directions. These were old semi-dwarf trees, about twelve years old. The patchwork of plantings, with some trees on a trellis and others free standing, was something I saw in many of the orchards I toured. In the fall, months later, I saw many of those tall, trellised trees right before harvest, their branches weighed down with apples. Their crown would be toppling over, heavy with apples pulling their thin limbs to the ground. It was an apple waterfall. Looking at their lower limbs, strung up and unable to bear the weight of the apples independently, made my own arms feel tired.

Later, I saw a very different orchard with trellised trees. I was driving to an interview with a large wholesale grower who also ran a farm stand. As I was approaching my destination, I drove through countless rows of what could have been vineyards. The trees so carefully lined up, forming narrow hedges. Their limbs secured to the trellis lines, so their branches were at a 90° angle to the stem. I drove to the top of a hill, and pulled into a parking lot. I got out of my car and looked down into the distance. Thick, fuzzy lines of green ran parallel for half a mile. If I looked into the distance and squinted, it was like looking down into rows of young thyme.

Orchards increasingly depart from the romantic vision of large, looming old apple trees, the upper branches only accessible with the use of a tall ladder or the ambition and dexterity of a youthful climber. Standard trees are a size that would grow naturally from seed, and they commonly grow to a height of over 18 feet, and can reach over 18 feet wide. In short, they fill a lot of space, and each requires a lot of focused attention in terms of care and maintenance. Whenever I went to a field day at an orchard with standard trees, the advice was the same: Get rid of them. Why would you keep them? The labor required to make them healthy is too costly. Semi-dwarf trees only reach about 15 feet. Those that shy away from dwarfing trees, for whatever reason, are planting these intermediate associates. I got the sense that planting standard trees in a commercial orchard would be considered utter madness by the grower community, while the dwarfing trees were commonly considered the stock of the future.

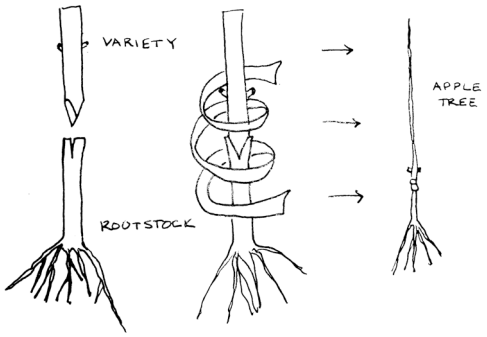

Figure 3:
Trees are a product of a variety grafted onto a rootstock

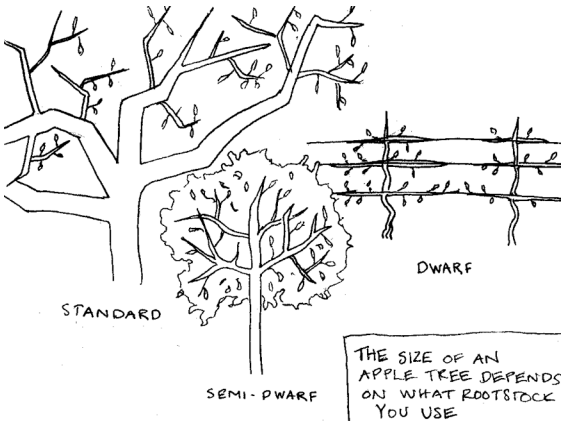

Figure 4: Standard trees are the size that would be grown from seem. Semi-dwarf and dwarf rootstocks restrict the height of the tree.

Figure 5: Honeycrisp trees on a B-9 dwarfing rootstock

Dwarfing rootstocks and trellis systems are significantly changing the orchard landscape. They represent a process of modernizing farming that has been documented elsewhere and has a significant historical trail (Fitzgerald 1991, 2003; Palladino 2003). The trees have been altered to behave more rationally and efficiently, as will be described later in this paper, and this process can be seen to be embedding economic interests into the trees and crafting them to the capitalist market. This paper will add depth to the basic narrative of modernization by discussing the specific ways in which the technologies shape economic action and the principles of production. It draws on a perspective that I call *the biology of markets*, where animate materials relate to the institutional structure of the economy. Dwarfing trees are a technology that enables a more controlled production process and a standardized participation in the apple market. They *also* encourage experimentation, creativity, and customization in the activities that lead up to exchange. In this sense, they are a *habilitating* technology (Callon 2008), in that they expand the types of activities that can produce apples so that they can be catered to specific landscapes and conditions. Habilitating technologies also influence the role of the farmer in the orchard, and have the potential to create more agency and a different kind of economic individualism. Building on this argument, I will suggest that dwarfing technologies in apple production are a habilitating technology in which farmers are expected to customize their orchard, leading to more collaborative grower subjectivities. However, I will also argue that the possibilities for an expansion of agency have much to do with the institutional

structure surrounding production. Agency is not simply a product of technology, but the ways in which technologies and subjectivities relate to institutions and enable the negotiation of institutional structures.

Literature review

I have made the argument that biology is relevant for thinking about the economy. Elsewhere, I have discussed how biological differences can provide a foundation for social differences and boundary making (Article 1, this dissertation). In this paper, I suggest that biology is relevant for economic action at a more micro level, and this is another important aspect of the biology of markets. I draw on actor-network theory to describe how trees are part of grower subjectivity. Defining what objects are and do is also describing what we are and do, because we are defining our capabilities and desired capabilities. The orchard landscape, in this framework, could be imagined as bionic: as an extension of the human body. It could also be viewed as bionic in the sense that trees are mechanized and enhanced versions of themselves, altered by human artifacts. This paper will discuss how the creation of technologies can shape subjectivities differently.

Actor-network theory provides a literature for considering the relationships between the dwarfing rootstocks and economic action. The second literature that is integral to the paper is inspired by institutionalism and work on modernization processes. This human-plant association does not happen in a vacuum, but in a social and economic world, where activities are encouraged and constrained by institutions. Scholars like Fligstein (1994), Nee (2005), and Zelizer (2007), have suggested that rules organize action, and by doing so, have their own influence on

the ethic or culture operating in an industry. In other words, they also influence the practices that economic actors perform and the types of subjectivities that actors can inhabit. While technologies may shape subjectivities, the extent of their influence and the degree to which they alter economic agency has much to do with how they interact with broader structures.

Habilitating Technologies and Subjectivity: Bionic Landscapes

Shaping things is shaping people, in a sense. Defining what materials can do alters the realm of possible or reasonable human activities. Bruno Latour made considerable waves when he suggested that *We Have Never Been Modern* (1993). The distinctions between the subject and object are blurry at best, he suggests, and the world "out there" does not end with the world "in here." When the biological world is defined as predictable and knowable, operating like nested clockwork, it is possible for people to be objective, and adopt a culture of scientific inquiry. That is, they can inhabit that subjective position. When gas becomes defined as fuel, a range of subjects emerge, from gas guzzling motorists to industrial farmers. Would these subjectivities, or the expectations around motorists and farmers differ if water or electricity were being used as fuel? Would their economic capabilities be different? An actor-network theory approach would suggest that they might. Not to mention how the modern car might have a drastically different shape or place in everyday life.

Objects, then, are never politically neutral, and always represent some kind of human labor. That labor embeds them with intentions and future purposes. Materials always carry 'congealed labor' (Latour 1994: 40). Because these materials

can travel through time and occupy space, those intentions also get carried forward, so that shaping things is a project in cultivating the future world of action.

Objects shape subjects, and in turn, technologies influence the possibilities and expected activities of economic actors, now and in the future. In his work on *agencements*, Michel Callon (2008) suggests that there are two different ways that technologies create individual subjectivities. The first is through *prosthesis*, whereby technologies enable people who are different to act the same and participate the same economic or social projects. A loom or numerically controlled machine that renders the natural differences between laborers irrelevant is an example of prosthesis. These types of technologies would be associated with the industrial deskilling described by Fitzgerald (1993). The second Callon (2008) calls *habilitation*. These are technologies that enable people to design their own projects, and assemble a greater array of materials in their activities. They could be seen to open up previously inaccessible processes in production to human intervention and create new arenas of skill and knowledge. In the prosthesis model, the individual is altered to fit with the environment, and therefore agency, in any meaningful sense, is more limited. In habilitation, the environment is altered so that people can craft their own conditions of production more precisely. A similar model was used by Barry (2001) in his discussion of a disciplinary diagram and an interactive diagram, where we can imagine an actor at the center of a web of production that either mandates what activities the actor must perform to complete a task, or allows for the actor to choose the task and engage with the tools that will perform it. Murdoch (1998) also uses actor-network theory to describe *spaces of prescription* and *spaces*

of negotiation. There are aspects of a network that mandate certain activities to occur, and make it almost impossible to deviate. There are also aspects that are negotiable. Callon is arguing that those features of the network, prescriptive or negotiable, can be located in how the tools of production are crafted.

The role that technology plays in defining subjectivities is important in the context of the biology of markets, because it has particular implications for thinking about how biological materials can be integrated into an economy that is so fixated on standardization and predictability. There is a strong pressure to adopt technologies that enable greater control over plants, but what that technology means for the practice of farming is unclear. This paper will seek to clarify some of those possibilities.

Modernizing, Rationalizing & The Institutional Structure

The concepts of prosthesis and habilitation and their relationship to economic subjectivity are particularly interesting for agriculture because the incorporation of farmers into capitalist economic systems has been a conundrum. Plants are an economic problem, in part because they are so reluctant to behave like machines. Multiple times throughout my fieldwork I heard growers complain, "our factory isn't under a roof." Beyond the problems associated with irregular weather and a lack of climatic control, plants also resist the kind of rational accounting so pivotal to capitalist production (Weber 1968: 161-166). As Fitzgerald (2001; 2003) illustrated in her account of 1920s shifts in farming, concerted effort has been allocated to taking a technocratic and scientific approach to farming, rationalizing and engineering the farm according to broader visions of the modern state. If only

plants could be more predictable, surpluses and droughts could be smoothed over, as a steady stream of food would predictably meet a calculated demand.

Modernizing technology is also about rationalizing economic actors, and generating a type of individualism. The capitalist economy is based on a shared rationality, according to Weber (1968). This rationality allows people to interact smoothly in the marketplace and creates predictable behavior that enables accounting and planning for the future. Both Marx (1933) and Weber (1968) agreed that accounting was enveloped with the systematic organization of labor (Bryer 2000). As a result, people can independently go about their work with a clearer sense of how their labor will be rewarded, and how their labor fits with the activities of others. Spurred forward with neoclassical ideas of the free market, self-interested behavior is thought to maximize the efficient use of resources and contribute to the overall economic wellbeing of a society. This type of liberal individualism is contingent on the stability of human behavior and the material world, and is impeded by expressions of random will that can muck up the calculations. The result is the ideal actor encouraged by the economy, *homo economicus*, is utility-maximizing, perfectly rational, and has control over actions. "Economic man is a pleasure machine," the economist Geoffrey Hodgson (2012: x) suggests, "whose preference function appears miraculously, without reference to human evolution, and seemingly detached from his social and natural environment." The supposed detachment, both social *and* material, is an important aspect of how economic actors in capitalist systems are theorized, and by the same token, encouraged to be.

Callon (2008) argues that both prosthesis and habilitation enable abstract, rational, calculating economic agents to emerge. However, the second, he argues, produces what he calls *homo economicus 2.0,* whereby technologies are crafted to enable people to design their own projects, and choose their own assemblages, and as such, have greater agency. Habilitating technologies have the possibility of liberating actors by opening up new areas of productive distinction and skill, rather than the dictates of a single-purposed, homogenizing tool. The two technologies also have implications for considering the individualism advanced in modern capitalist economies. The individualism of prosthesis is one in which the actor is so constrained so as to be perfectly predictable and reliable. Differences between people become irrelevant. In habilitation, individualism centers more on differences and the particularities of the self, and, as I argue, an orientation towards customization. They are both oriented to a form of rational accounting, be it the rationality of perfectly replicated activities or the accounting of personally maximized efficiency.

Rationalization is important. There is an economic pressure to make the material world, and particularly the biological world, more predictable, rationalized, and accountable. One of the most significant arenas where that rationalization occurs is resource industries and agriculture, where the role of non-human economic actors is so significant, and the effects of nature, a plague to be overcome (see, for example, Worster 1982). Technologies, like tractors, fertilizers, and pesticides, or as Palladino (1996) discuses in the case of Britain, plant breeding, are large parts of modernization projects in agriculture. Hamilton (2003) has discussed

the introduction of frozen concentrated orange juice as a rationalizing project, reducing the economic effects of seasonality and natural crop damage, while Bos and Grin (2008) discussed changing the flow of a river as a modern project in improving the sustainability of local pig husbandry. Orchards are no exception: the orchard landscape is altered to liberate farmers to the habits of the market. Callon (2008) would suggest that the ways in which technologies are introduced to the orchard should also influence *how* that liberation occurs. Does it occur by enabling actors to dissolve natural hindrances to market participation, and prescribing a single solution? Or does it occur by expanding the practices that lead to economic participation? Invariably, technologies do a bit of both, but it is useful to think of the arenas in which technologies create more standardization and homogenization, versus more creativity and innovation. In the case of dwarfing rootstocks, I will argue that they contain more moments of human intervention and can encourage a more customized landscape. In doing so, they can also facilitate a more collaborative relationship between growers.

If the pressure to adopt technologies is part of a broader economic project to overcome ecological constraints so that actors are free to be enveloped by the dictates of the market, it is unclear how liberating those technologies could be. Callon may overstate the importance of the technology in determining activities and the freedoms they afford, by neglecting to consider the world of production they enter into. If we reject the notion of the free market, then agency is not only determined by the practical constraints of action but the broader structures around them.

Institutionalists have suggested that there is no market devoid of a coercive structure. Instead, there are formal and informal rules that shape the decisions of actors and the culture among actors (Fligstein 1994; Nee 2005; Bourdeiu 2005). Rules, in other words, also constrain actions and create opportunities. They affect what activities are encouraged and discouraged. By implication, while technologies may be liberating in their design, how this liberation gets expressed in economic practices relates to rules of play and the cultures they create.

Rather than a process where technology creates agency, or institutions shape agency, this paper will consider how subjectivities are created at the intersection between the two, and through their negotiation. Dwarfing rootstocks are a habilitating technology and expand the possibilities of production. Landscapes are customized to the particular orchard, and institutions reflect practical diversity by supporting knowledge sharing and collaboration. On the other hand, markets that encourage efficiency and the production of a particular apple aesthetic can be constraining, not to mention the introduction of other technologies that standardize the use of rootstocks and make them competitively required. Agency exists in the ability to negotiate constraints and change institutions. In the context of apple production, I will discuss how clubs may be one arena in which that negotiation occurs.

Methodology

The data for this paper has been generated through qualitative research with growers in the Midwest. I draw my findings from interviews with 37 growers, and seven other industry actors including breeders and marketers. Importantly, most of

the interviews were accompanied by a tour of the orchard. Most growers that I interviewed, with the exception one or two growers, were in the habit of visiting other orchards in the area. Often, after the interview, growers would take me on a golf cart or truck to drive around their farm, explaining what they were doing and allowing me to ask questions about the various objects and arrangements in the landscape. I asked about changes to their orchards, why they had adopted a particular approach, and whether they had found it to be successful. Perhaps because of the custom of reciprocal orchard visiting, growers seemed comfortable and well-practiced when explaining things, and seemed generally enthusiastic to show me what they were doing. There was likely some bias, in that those that would be willing to talk to me and discuss their orchard would be more likely to be excited about their operations. However, even growers who were disinclined to speak with me, or simply too difficult to get a hold of, were often very active in the broader grower community, and clearly participated in the types of visits that seemed to be characteristic of Midwest apple growers generally. In short, while the growers I spoke to may be more engaged in the types of technologies and experiments that form the foundation for this paper, I have adequate evidence to suggest that these interviews were not uncharacteristic. Moreover, I interviewed all sizes of farms, ranging from a few acres to five hundred acres, and producers who engaged in wholesale and direct marketing. I interviewed people who were clearly leaders in the industry. I interviewed people who ran their own packing lines and had over a hundred employees, as well as people who had only recently entered the industry. The youngest interview participant was 21, the oldest was 87, and the mean age of

my participants was 59. In general, I did not get the sense that I was interviewing an unusual or overly experimental and modern population of growers that would be tertiary to the functioning of a mainstream industry.

I also draw my findings from attendance at conferences, field days, and workshops. I attended small field days with 15-20 growers where they discussed things like spraying and pest management, and larger national conferences with 500 attendees like the USApple Crop Outlook conference, or meetings of the International Fruit Tree Association. Furthermore, I read publications by American Fruit Grower and the Good Fruit Grower, and subscribed to their email lists. These conferences and publications further suggested that the conversations I was having with growers and the technologies I was seeing on their orchards was characteristic of the industry overall.

To discuss changes in grower subjectivities in relation to technologies, I am focusing on dwarfing rootstocks because these were identified as an important change to Midwest apple production by growers during my interviews and orchard visits, as well as field days and conferences. Other technologies, like new types of packing lines or innovations in cold storage also could have been used, but my interest is primarily in the activities of growers and the relationship between growers and technologies in their everyday practices. Every grower I spoke to had something to say about rootstocks because they are a material that is necessary for the production of trees, and because there are a variety of rootstock options, they demand grower consideration. The potential for new rootstocks to have an influence on the shape of the industry and grower subjectivities is significant. The

result is that it is easier to demarcate these relationships between technologies, subjectivities, and industry structure like co-operatives. The only other technology that could have provided the foundation for a similar discussion would be the development of Integrated Pest Management (IPM). There are many ways that IPM is similar to dwarfing rootstocks in the ways that it demands a particular type of creative intervention. While integrated pest management would correlate to the general culture of customization and collaboration I discuss in the paper, its role in modernization and apple production is more obscure.

The New Orchard Landscape: Dwarfing Rootstocks and High Density Plantings as Habilitating Technologies

To reproduce apple trees, scion wood, or shoots from an existing tree, are grafted onto roots, or rootstock. Since grafting began centuries ago, there have also been rootstocks that are developed separately from varieties. Horticulturalists have made a more concerted effort to develop rootstocks over the past 150 years, and the industry has now blossomed and become economically vibrant independently of apple variety breeding (Webster and Wertheim 2003). Rootstocks can be disease resistant or react differently to different soils, but perhaps the most important variable aspect of rootstocks is their size. There's the Malling series rootstock, developed at the Malling Center in the UK, Budagovskys from Russia, and Genevas from New York. I encountered these three roostocks most commonly in the Midwest, but there are countless, ever multiplying numbers of rootstocks being developed and used. With increasing land prices and pressures to reduce fertilizer

and pesticide use, managing and concentrating production through the manipulation of rootstocks has also become more appealing.

Figure 6: Young trees being trained on a trellis, photographed on an orchard tour. This grower had decided to use old telephone poles to anchor the trellis because he had found a cheap supplier. In general, growers need to provide a good anchor so that the entire row does not blow over when there is a strong wind.

Smaller trees have three main rationalizing effects that make them more predictable. Firstly, they increase the number of trees that can planted on an acre, increasing per acre yield. Plantings on standard rootstocks are about 100-200 trees an acre, semi-dwarf plantings could reach 500 trees an acre, but fully dwarfing trees on a trellis can reach upwards of 1500 trees an acre. While each tree might be less productive than a full standard tree, the overall production per acre could be higher. My research participants rarely elaborated on this point. Instead, they often focused

on the speed at which the smaller trees came into production, and the higher quality of fruit they could produce.

"I think the biggest benefit is not the ultimate production." Ben told me. "The in-plant production is probably the same, and once you get a big tree going it produces a lot of apples, but the benefit is, number one, the time to production is drastically reduced. By the third year, we'll have a pretty big crop. Second year we'll expect to get 10-15 apples per tree." Rather than waiting ten years for trees to produce apples, growers can reach full production within three years. Reaching full production faster is beneficial because it allows growers to get quicker returns on their investments, which is important given that other technologies, such as irrigation systems and plant patents, have increased the cost of planting. It also reduces the time between planting and harvesting. The delay of time means that the economic context in which the orchard was planted could be drastically different from the economic context when the apples actually go on the market. The time in between makes planning and responding to changes in demand difficult. The speed at which trees start producing and generating a return to growers is also valuable as it enables growers to capture the increased value that is associated with new varieties that have a higher demand and lower supply.

One of the greatest assets associated with dwarfing trees is the quality of production. "So there, you say, a thousand trees per acre, you're going to want ten apples per tree." Ben remarked, mentioning the lower per-tree yield of dwarf trees. He went on to describe, at length, the qualitative differences facilitated by more grower intervention in the tree:

> "There's a little different thing with growing apples. When you have a relationship or a business strategy that involves a packing-house, it's not just about quantity. You have to have a high yield, and not only do you just want to say well I just sent a hundred bushels, and I got 90% pack out. That would be great, but if they all pack out into bags, you're not going to make any money. You have to target exactly how big you want those apples to be. So what we target is to be in that 85-90% pack out with over half of those being 80 count [larger apples]. Thirdly, and largely as a response to the introduction of a trellis system, it is easier to produce uniform apples and other aspects of production can become more mechanized and efficient."

The mechanization of the orchard and market pressures are aspects of production that I will discuss later as a contextual limitation to any liberating aspects of production. Here, it is relevant to note that the dwarfing rootstocks enable more control of the tree. Since the introduction of dwarfing rootstocks, growers in the Midwest have been able to produce apples that are more consistently red, larger, and with fewer blemishes. It's not only the facility with which growers can apply spray, but also the organization of the tree on the land that generates commercial benefits. For example, when I asked Russell how the dwarfing rootstocks influenced his production, he stated:

> "Well it's the system. With the dwarfing root, we plant north and south rows. We manage the height to about ten or twelve feet, and it's what's called a slender spindle or a vertical axe. The point is, the tree

> is only about four feet wide, so that sun on the East shines through to the trunk in the morning, and on the West, it shines through to the trunk on the West side so that every apple gets sunlight, directly. The spur leaves get direct sunlight, so that they build the carbohdrates for the apple. The apple gets size and color. Also we can manage harvesting much easier, and bruising."

An uninterrupted tree would grow with branches all around, spreading in every direction. For growers, dwarfing rootstocks enable more control over the orchard and create more moments in which human labor participates in the development of the plant. There are more moments of decision making, such as what type of dwarfing rootstock to use and how to train the tree in ways that capture the most site-specific benefits. Decisions that the tree would typically make, where it decides how quickly to grow, or how tall to grow, is replaced by the grower and this expands the possibilities to suit the direction of the sun or the constraints of human height for picking. The labor of the tree where it would hold the branches, heavy with apples is replaced by a trellis, where growers can operate more control. In these ways, the dwarfing technologies can be seen as a habilitating technology.

Many of the growers I spoke to also decided to use different kinds of dwarfing rootstocks depending on their soil and climate. They also combine particular rootstocks with varieties to create the types of tree that they believe would work best on their site. For example, Walter explained how he had chosen rootstocks for his farm based on information and experience. "This is on Bud-9." He explained, pointing down a row of trees in the orchard. Bud-9, short for

Budagovesky 9, grows to about 30% of a standard tree and is known to be precocious, or generate trees that are productive quite early, while also being winter hardy. “Bud 9 was really growing well in some soils. We have a lot of sandy loam here, so we need a strong rootstock. Our farm was afraid of an M-26 because of fireblight [a common apple disease], so we went with a Bud-9. And we have some on Nic-29. That’s these here. They grew a lot better. Now these are two years older,” he said, pointing to a dense row of green leaves, about a foot taller than me. “But those,” pointing to the row on Bud-9, scrawny and reaching about shoulder-height, “won’t match these in two years. So it’s really a learning process through everything.” There are also many types of semi-dwarf and standard trees, but new rootstocks that growers were introducing into their orchards were overwhelmingly dwarfing, and sometimes quite diverse. The way they behaved on the orchard varied, and often I saw rows with different combinations of rootstock and variety marked at the head of a row. Moreover, training them and placing them purposefully on the landscape to maximize sunlight and production is much more varied and creative.

As Russell suggested in his discussion of sun penetration and tree organization on the orchard, training is a technology that becomes immensely more useful with a small tree whose shape is more malleable to manipulation. Many of the growers I spoke to use a technique called the slender spindle. The tree is anchored along a central support, the branches pruned to be slender and grow horizontally, and the height encouraged to grow to about eight feet. There is a tall slender spindle and a super slender spindle, whereby growers plant closer together and encourage the tree to grow taller and less wide. A super spindle is planted closer together and

encouraged to grow taller than a regular tall spindle. In a spindle training system, only weak branches are kept that are 30-50% of a central trunk, or "leader," which is also quite thin. The effect is almost vine like, and "old wood" is constantly replaced with "new wood" that is highly productive. The branches are always tied down when the tree is young, often below a horizontal position. Tying the branches encourages the tree to produce apple more quickly.

Figure 7: Honeycrisp trained using a slender spindle method

Others used a training system called a vertical axe, where the tree is probably not on a trellis but staked, and the branches grow naturally at all angles around the diameter of the tree. While the tree is young the branches are pulled down with strings or pushed down with plastic spacers to grow more horizontally. Often, the vertical axe produces “tables”, where the first branches, shooting out at 90° angles, produce a circular ledge of production a couple feet from the ground. Other growers were experimenting with a V-trellis or A-trellis, where the trees staked on an angle and alternated so that if you stood at the head of a row and looked straight down, it would form a V or an A shape.

Perhaps the newest training methods are the bi-axis or bi-baum, and the fruiting wall. In these systems, an incision is made near the base of the tree that encourages a branch to grow, or two incisions encourage two branches to grow. All other branches are pruned so that either the one or two other branches are encouraged to grow to the same diameter as the initial branch. Those branches are encouraged to become leaders, so rather that having one central leader that all branches emerge from, there are two or three leaders and either minimal branches, or none at all. The trees are packed closely together and they look the flattest of all the plantings. While the dwarfing rootstocks create the plant to more suitably reflect economic demands, like higher productivity and more efficient energy use, having smaller, more nubile branches also enables more manipulation of the plant and varied forms of grower intervention into their growth.

The dwarfing rootstocks create new moments where decisions the grower makes replaces those previously made by a tree. They decide where to put a branch

and which direction it should grow. They consider how to capture the most amount of light. They remove wood in an effort to channel nutrients elsewhere. The growers are involved in making these choices, and fitting the tree to other aspects of the orchard such as soil qualities and sunlight.

In this sense, dwarfing rootstocks could be considered a habilitating technology. They allow growers the ability to assemble the orchard world in a way that is more suitable to their landscape, and in this way, could be seen to generate the type of individualism Callon (2008) refers to, where assemblages are more varied and customized. In the following section, I will discuss how this particularism facilitates a general culture of collaboration. Everyone has a different orchard program, so sharing information is not going to give anyone an advantage while holding it in would not be beneficial. If growing apples were expected to be the same on every orchard, such that a technological improvement for one person would easily translate to improvement for another, sharing local advantages would be foolish: sharing innovations would provide a benefit to others while undermining the possibility of having a competitive advantage. If every orchard is different and practices localized, conversation carries less of a risk.

Professionalism and Experimentation

I saw every training method on my orchard tours. Many of the growers I spoke to had semi-dwarf trees rather than fully dwarfing trees, and many more had a combination of both. A handful of orchards had very large standard trees. Most of the growers who still had larger trees were not engaging in wholesale, and instead

were selling directly off the farm or ran u-pick operations that were based as much on agri-tourism as apple production. There were two exceptions, whereby larger wholesale growers had chosen to plant on semi-dwarf rather than dwarfing rootstock, and in each case they said that it was because the semi-dwarf worked better in their soil and climate. For those that were planting on dwarfing rootstocks and using a new training method, they often had multiple different methods in their orchard that they were experimenting with. The majority of growers using these methods referred to a trial-and-error planting method, where they would see what worked and reproduce it. Many of them had areas of their orchard dedicated explicitly to experimental methods. In other words, growers are constantly assembling and re-assembling the actants in their actor-network to produce the apple they desire.

The dwarfing rootstocks participated in a type of experimental spirit that often tied them to other growers, occasionally in distant places, or it helped build relationships to other growers. Many had blocks dedicated to experimental varieties. The dwarfing rootstocks ease the risks associated with experimentation by requiring less space for new varieties and quickening the time to production. The result it that less resources need to be spent on trying things out, and if a variety turns out to be inappropriate for the orchard, or simply undesirable, not so much is lost. Waiting for six years to see if a variety is a good, and holding up 70 square feet of space, is a much more onerous investment for something that might not work out.

Growers use experimental plots for several different types of trials. Firstly, they can be useful for establishing whether an existing variety would be a good

addition to the orchard. The variety may be desirable because it recently gained more of a market following, or because it could be resistant to a pest or disease that the orchard has had difficulty controlling. Experimental plots can also be useful for testing newly released varieties and checking whether the variety will grow well in the orchard conditions. Grant, for example, had been receiving scion wood from all over the world to test in his orchard. He had been testing trees from New Zealand, Belgium, and England, as well as Canada and other parts of the Unites States. Scott and Frank had each been testing varieties for a university for years, so when the university pulled funding out of their breeding program, the two growers planted large tracts of the defunded trees in their orchards, and several other growers did the same. Growers also use experimental plots to develop their own varieties. One grower in the Midwest is notorious for having an extensive collection of experimental varieties that he had been developing for over twenty years.

Experimental blocks are an important part of what it means to be a modern grower who is producing good apples. Experimental blocks also provide the foundation for experimental communities. I asked Glenn, a large grower who also ran a packing line, how he chose new varieties. He described how travelling to other orchards and testing varieties became an integral part of his localized orchard program:

> "Too many people pick the right varieties the wrong way. They tend to ask the nurseries, and then the nurseries tell them whatever they're long on. I mean, we put a lot of work into that. This goes back to when I bought the orchard and it was this little apple orchard and it wasn't

> doing very well, frankly. I knew that if I was going to survive, I was going to have to, somehow or another—we were never going to be in a place where we could be the cheapest. I knew that if we were going to survive we had to do things that were different. We couldn't be a commodity producer, so we started way back when, testing a lot of new varieties from all over the world. Being here we're relatively isolated... If we were going to survive and understand the state-of-the-art technology, we were going to have to travel to see it. In that process of getting used to automatically travelling wherever we have to go, to see whatever we had to learn, a couple different things happened. We got exposed to lots of different varieties, lots of different breeding programs, lots of different flavor profiles…you asked how we pick out new varieties. We have, at any given time, last year I think we planted 60 some new test varieties from around the world. So it's become part of our core strategy."

Having an area where growers tried new trees and growing strategies was common among the growers I interviewed, and those that didn't identify a testing block still narrated many of their practices as based on experiment or trial and error, and communications with other growers about their respective experiences. The dwarfing rootstocks are part of a broader trend towards *practice* as a type of learning and knowledge development: as a system of repeated exercise, development, and individual crafting to assemble the production best suited to the grower and his site. This practice is what Callon (1986, 2008, 2010) would call

agencement, where an assemblage of heterogenous materials is carefully built, almost in a dance-like process, to get the apple tree to cooperate in the growers project with the outcomes he desires. It is also tied to the skill building and knowledge communities that have been discussed in other areas of agriculture (Bell 2004) and in contrast to the deskilling commonly associated with modernization (Fitzgerald 1993).

The Institutional Context

Collaboration in Production: Expanding Agencies

In this paper, I have emphasized the ways that dwarfing rootstocks encourage grower agency by opening up new ways to produce apples that growers can craft to their economic goals and environmental conditions. It is a landscape of action and experimentation. It may have not *created* a spirit of innovation and activity that contribute to the subjectivity of apple producers, but it certainly participates and encourages particular types of practice that are grounded in knowledge production and exchange. One way that we can see this subjectivity expressed is through the development of informal and formal professional organizations that solidify these types of subjectivities. In my experiences observing grower events, there is a strong tendency to share knowledge and discuss new farming methods. Growers visit each other's farms, and participate in a variety of local, regional, and sometimes national events. Take, for example, the experiences relayed by Ben, a mid-sized Midwestern grower selling for direct market and wholesale:

K: Is there a lot of collaboration or discussion among growers in this region?

Ben: A lot. I think that the apple grower's association is good. The membership is high. That ranges from the little person that has ten trees, to the biggest ones. The chance to talk with those people as well as the really little orchards is invaluable. Even here, we have, you know—our discipline of doing it varies. We get together for breakfast the first Tuesday of every month. And that happened long before any networks or anything. That was just a bunch of farmers getting together for breakfast. To share ideas and share how we do things, and really work on being open with one another, and work on changes in our philosophy, from, we are not in competition. Sure maybe from the retail side, we've got markets down the road from us, but what we do is different. What's good for them is probably good for us and what's good for us is probably good for them.

Growers consistently visit each other's orchards, and many are in daily contact with others during busy orchard seasons. They knew about each other's farm markets, they knew about each other's u-pick operations, as well as their varieties and the types of plantings they were using. They also knew how their contacts were doing that season, and it would be fairly common for growers to buy apples from each other for either the direct market or wholesale. During field days, growers would assemble in a building for a workshop before going out into the orchard and talking about the orchard in the context of the workshop topic. An

observer could easily notice the discomfort a grower would feel having a collection of others scrutinizing his or her orchard. Yet there is also a great advantage to amassing a collection of weathered experts and fresh minds on your orchard to talk about problems. On an orchard tour organized by the International Fruit Tree Association, I was at a high-density orchard where a young grower had recently moved onto high density planting. "I know there are a lot of experts here," he said. "Could one of you demonstrate how you prune? I'd like to see how *you* would do it." Several other growers noted how their experiences with high-density had been wrought with many mistakes and failures. The general consensus during the tours I've attended has been that nobody gets it right the first time, but most are willing to talk about their successes and failures.

The International Fruit Tree Association emerged from a desire to develop and exchange knowledge about new tree fruit technologies, and dwarfing rootstocks in particular. Originally, it was called the Dwarfing Fruit Tree Association, and it was an effort to learn about dwarfing rootstocks so that they could be introduced into North America. It is the second largest national apple focused organization, behind USApple, and was started by a group of growers. I attended meetings of the International Fruit Tree Association twice for my research. Many growers that I spoke to mentioned that they had met people on the tour that they later visited, and sometimes entered into business relationships with. Many of the members of the IFTA board have also held positions on US Apple, and they may also hold positions in regional organizations.

Touring is a central aspect of IFTA, and illustrates how growers discuss their approaches to apple production, as well as how they are positioning themselves in the apple market. On a typical tour day, attendees meet at 7:00am, get onto a series of charter buses that are broken up into groups that take different routes through the orchard. There will be four stops in the morning, lunch, and four stops in the afternoon. For each stop, everyone gets off the bus and is met by the owners of the orchard. People on the bus often know each other, and are quick to identify newcomers, as I experienced. There are small growers doing u-pick or direct marketing. There are larger growers who only do wholesale. There are packers, suppliers, and extension agents. Attendees look at small farms, large farms, direct marketers and processors.

When growers give a tour of their orchard, they often provide a narrative about how they came to a particular arrangement. For example, during a recent tour a grower discussed his plantings on a type of rootstock called *Mark*. He had planted some McIntosh apples on Mark rootstock, and after about five years the trees started dying. The grower checked for the usual disease and pest problems, and could not figure out what was wrong. Eventually, he removed the wood from the base of the tree and discovered a pest called the dogwood borer. He had not noticed the signs before because the trees did not have the usual holes on the outside of the base that is normally associated with the pest. After some further investigation, the grower dug up the bases of the trees and realized that the bug had entered the tree below ground. The practice of narrating a problem and solution occurred frequently

on the tours, and it demonstrates how growers express their grower-*ness* through the act of assembling, refining, learning, and experience.

Markets: You're not Growing Trees

While dwarfing technologies could open up a world of opportunities and experimentation, and create a culture of collaboration, they are also constrained by market institutions that determine the goals of growing, and a culture of production oriented towards large, red apples. At an orchard workshop in the spring, I went to a talk on dwarfing rootstocks and high-density plantings. We stood in a forest of delicate, miniature young apple trees, strung along a set of wires. An extension agent was explaining, "you need to stop thinking about producing trees. You're not producing trees. You're producing apples." She continued to explain how high density plantings would be good for growers by channeling the energy the tree consumes into the apples. The less wood the better, she suggested. A similar comment was made to me on a bus during an orchard tour in New England. "We used to grow an apple forest that had fruit, and now we grow a fruit forest that has trees" These comments allude to shifting principles in the production that refocus attention away from trees and towards the commodity being produced. Because that commodity and how it is valued is determined by the market, shifting attention to the apple also means orienting activities towards market-determined goals: the size and color that growers so commonly mention.

Figure 8: Dwarfing trees using an espalier training method. I saw this orchard on a tour, and many growers remarked after we left, “too much wood! How does he make any money?”

The goals of production are largely influenced by the market, so that even if the technologies enable growers to vary their production programs to suit their orchards, the extent to which the programs are liberating is context-dependent. The role that these economic contexts play in the grower-tree actor-network illuminates the way that technologies can be both limiting in some ways, while being constraining in others. If the goals of production cannot be negotiated, technologies that allow growers the ability to more intentionally develop their own growing programs can be simultaneously limiting by placing an onus on the grower to be intervening in the tree and actively engaged in producing the most uniformly large, red apples in the most uniform way.

The Onus of Adoption

The expansion of agency that can accompany a habilitating technology should also be couched by the possible corresponding onus of adoption. The dwarfing rootstocks have encouraged the introduction of new technologies, and these technologies require dwarfing rootstocks. Picking platforms can roll through orchards so that workers do not have to use ladders to reach the top of the tree. Picking is faster and more efficient, but it's also safer. Several growers mentioned that their farm laborers prefer the picking platforms because they reduce the physical strain associated with harvest. On the other hand, growers also mentioned that pruning would become more standardized, so that it required less employee training. Spraying is more efficient, as it is easier to penetrate the entire tree, and because the reduced wood enabled the spray to pass through rows. Every grower that was using the trellis system suggested that they could use less spray, and they had less drift, which also improved things like relationship with neighbors, and particularly neighbors farming organically if the grower is using synthetic chemicals. The introduction of the dwarfing rootstocks enables the introduction of new actants and more grower control over the landscape, but more control may also become required to stay competitive.

Dwarfing rootstocks are also confining because their adoption is required. The mechanization of the orchard landscape in response to the introduction of dwarfing rootstocks and trellis systems also means that they have become increasingly necessary for participation in the industry, and have become a

technological representation of what it means to be a serious grower. In order to stay competitive and use the new efficient technologies, dwarfing rootstocks and trellis systems *have* to be used. When I asked Ben whether he was moving towards a more high-density orchard, he said, "Oh absolutely. Yeah anybody that's not planting trees on dwarfing rootstock is living way in the past, unless you had a strategy like you had a little orchard that was for pick your own and you just were going to have a bigger tree." Doug also referred to this sense of an obligatory or professional use of dwarfing rootstocks in his explanation of having different densities of plantings on his orchard:

> K: Why is there a difference in the density?
>
> Doug: The research, especially coming from Europe where orchards are planted very intensively, where land is very expensive and good fruit land is scarce… Michigan and New York and the west are 1000 to 2000 trees per acre, and our greatest density is about 700. We're moving in that direction but not anywhere near where the *real* apple people are.

High density has become a foundation of what it means to be a *real* grower, partly due to world that has become built around it.

Intersecting Subjectivities and Institutional Negotiation

The pressure to grow the perfect apple and speed up production can also make growers more vulnerable to the turbulence of the market. A byproduct of

grower flexibility is more pressure to respond quickly to the whims of the apple market. Elsewhere, I have suggested that commodification processes and market processes exert pressure on growers and create sameness in apples (Article 1, this dissertation). Paul, who grows about 500 acres in the Midwest suggested.

> "The problem is, we have tremendous horsepower to produce anything in the agricultural environment. So, if we're just looking at apples, there's huge horsepower to take anything and produce it to levels that are beyond the demand… every variety would go through that economic curve where, if your on the front end of it, of a good variety, you made money. If you planted on the tail end, you're now in the over-producing line and so every variety of any quality typically was destined to become non-profitable in a pure form… You're planting products in orchards that are, these days, in the 20,000 dollar an acre establishment costs. You're putting in varieties that take that level of investment and you are going to be the one that suffers, in the end, if it is going to be a very successful variety."

The 'increased horsepower' associated with technologies like high density planting can generate considerable risk. The ability to respond to the market and plant varieties that have grown in popularity also makes the market fluctuate more, and creates instability. The dwarfing rootstocks and a spirit of experimentation and change are not liberating if those activities are dictated by the market. Many of the growers I interviewed mentioned that the pressure from wholesale markets has increased with the conglomeration of supermarkets, who can now make quite

specific demands about the redness and size of the apple that they are willing to purchase.

For some growers, buffering against economic turbulence means participating in a variety of markets, including direct sales on site, farmers markets, and u-pick. For many, assembling a variety of markets into their orchard project is integral to their identities and survival. Take, for example, Russell's approach:

> "I told you we had Jonagold and we took them all out. I have two or three varieties of Jonagold and they were the best possible apples, but it was at a time when Jonagold was going redder and redder, and when I shipped them to the packing house, they went "well, what did you do with the red ones? Did you take all those for yourself." So now, to hell with them. That's my marketing angle."

However, simply accessing different markets may not be enough to create stability for growers, particularly those that do not have access to customers in an urban center. Wholesale growers are at a particular disadvantage. They are not allowed to talk to each other about price, but they are participating in the same markets with increasingly fewer buyers.

When I asked growers how they might get a sense of what price they should expect for their apples, they often said that they would look at the prices they were receiving in the supermarkets, or reports about the state of the industry overall. I was perplexed about why growers would never just ask their friends and neighbors. At one point, I asked a grower whether he ever just asked others what they were asking for their apples, and he said, very coldly and directly, "no." I was truly

surprised that growers, who mentioned talking to other growers daily, never talked about price to each other, and my naïveté lead to a significant period of confusion. Nonetheless, eventually a grower mentioned, off-record, the discussing price would violate anti-trust law, and no grower would tell me they were participating in collusion. Moreover, establishing a wholesale price for a large supermarket as a lone grower could be far from a negotiation. It wouldn't even be a conversation, but more of a faxed price sheet. Doug summed up the evolution of wholesale retail pricing for me:

> "20-30 years ago we would have a produce buyer from a retail distribution center—from a grocery store chain, for instance, probably based out of Milwaukee—he would actually come up in the fall, and they would walk through the orchards and look at the crops, and we would visit with them. It was definitely a face-to-face kind of relationship we would have with the buyers. Now with consolidations and mergers and bankruptcies we've gotten to the point where, to talk to the buyer, for instance, we would call Dallas, or some place in Florida. I mean, we would never have any face-to-face meetings with the buyer, and their only interest was price. They'd say, ok, fax us a price sheet. That's all they were interested in, the price of our apples, and as grocery store chains got bigger, we were too small basically for them to do business with."

What emerges in the industry is a tight community with the power to grow a lot of apples according to market demands, but very little control over the actual

marketing of those apples unless they are selling directly or participating in a cooperative.

Instead of dealing with retailers directly, many growers sell through a packinghouse, which negotiates a price for a group of growers. Generally, a packinghouse operates as a broker. They take the apples, sort them, and sell them, and then pay the grower the sale price with deductions for their services. Growers have different perspectives on the grower-packinghouse relationship, but generally, they do not negotiate a price, and only receive information about the price after the apples have been sold. Some growers did not mind the arrangement, and greatly appreciated the work of packers who would take the tiresome marketing and price negotiations off their shoulders. Others mentioned that it could be frustrating to wait for the sales slip.

In some cases, the quality and price of the apples according to the packout slip differed significantly from the impression the growers had when the apples left the farm. Tim, for example, suggested that growers seemed to bare a disproportionate amount of the risk of production, while having so little control over price. I asked him whether the price gets worked out before the apples reach the packing line. “So, they do all of the marketing,” Tim said, “and the grower is charged between 4 and 5 percent, and you pay for that marketing without really knowing what it is. And, we have no say in what price they’re going to get. So they determine it. They work out the number with the buyer, and then pay the grower, based on that.” Tim, a fairly young, new grower, had mentioned an interest in reducing his dependence on wholesale. “Do you have any idea what price they’re

going to work out?" I asked. "No idea." Other growers relayed complete breaks with packinghouses based on what seemed like unfair assessments. They were clearly reluctant to give details, lest their identities and discontent become public.

While new technologies like dwarfing rootstocks may enable growers to assemble their orchard in ways that are potentially liberating, sharing a market, an oligopolistic market no less, curtails the extent to which the habilitating technologies would lead to an economic actor with more agency. Having little control over standards and price means that the project may be flexible, but the goals are predetermined, and the results can be stifling.

Club apples

Club apples are patented apple varieties that have licenses associated with them that somehow limit their production. One of the only consistent characteristics of club or managed varieties is that they are associated with the establishment of a cooperative. A cooperative can, among other things, discuss price and coordinate marketing strategies. They enable growers more abilities to craft the economic aspects of their orchards. Here, I suggest that clubs are a function of the constraints of the market and collaborative nature of apple production.

Two of the clubs that were present in the Midwest grew from collaborative, informal relationships that growers had already established. One of them actually developed from conversations that people had during meetings for the International Fruit Tree Association. One of the growers I spoke to, Grant, suggested that the idea of managed varieties came from conversations with growers at the IFTA. "So they're

starting at some of these get-togethers and tours," he said. "There's a fair amount of barroom discussion about, you know, what are we going to do about this?" He was referring to unfair economic conditions and decline of Mid-sized growers. "What we really had to do was elevate ourselves beyond the commodity marketplace. We had to start to behave like brands…so that really, those discussions became the start of the whole notion of managed varieties."

In conclusion, grower subjectivity has become increasingly organized around taking control over orchard operations and assembling the materials they think will help to accomplish their goals. The increase in the ability to assemble materials relates to the development of habilitating technologies like dwarfing rootstocks. This would lead to an increase in individual agency, as Callon (2008) would suggest, and also an increase in collaboration between growers. However, they are constrained by institutional conditions relating to market pressures and pricing structures that limit agency, and limit collaboration. Clubs can be seen as a way to capitalize on the expanding opportunities afforded by technologies like rootstocks by negotiating the institutional structure of the industry.

Conclusion

The introduction of dwarfing rootstocks is a technology that opens up new spaces for grower intervention in apple trees. While semi-dwarf and standard trees would be pruned and trained, the smaller trees can be arranged in a much broader variety of ways. The range of rootstocks available, paired with the expansion of experimental training methods contributes to the development of experimental

growing practices and there is an expectation that growers will assemble those types of heterogeneous actor-networks that are going to be most suitable for their site. In this sense, dwarfing rootstocks are an example of habilitating technologies as described by Callon (2008).

Growers are also expected to develop orchards oriented to producing the highest quality apples, and the responsibility for assembling the appropriate network falls on the grower. Yet, those agencies are limited by market pressures, and without the ability to carve out a unique market position it would be difficult to maintain a truly unique orchard program. The ability to organize the orchard in a way that is carefully crafted can be curtailed by competition that encourages growers to compete rather than collaborate on price, and have little power to negotiate the type of apple they produce or price they receive. Having diverse markets, or the ability to organize into a cooperative, can enable growers to have more marketing power and more agency over their production. However significant it may be, dodging mainstream markets is a rather superficial expression of agency. Without the ability to negotiate institutional arrangements, and the constraints they may impose, the role of habilitating technologies is curtailed. If dwarfing rootstocks simply enhance the responsiveness of growers to market changes, and the industrial orchard landscape is only oriented towards producing qualities of apples most prized by the market through the most efficient means, it is hard to imagine how the grower would be liberated or any creativity celebrated.

The role of technologies, then, is not simply a function of how they influence action, but how they exist in a broader context. If they encourage the types of

activities that can spur a renegotiation of the rules and associated economic ethics, an argument can be made that they expand agency. In the case of dwarfing rootstocks, they may be most beneficial for those who have been able to take the associated collaborative spirit and build it into the economic architecture of the industry such as those involved in club apples. If the power of technology cannot be wielded for the benefit of the user, it can only serve to reinforce and solidify the status quo, which is hardly a process of liberation.

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The Biology of Institutions: Clubs and the Institutional Advancement of Varietal Competition

Abstract

Club apples are new varieties that are associated with licenses that restrict the ways that they can be grown and sold. While the types of clubs that are emerging in the apple industry are diverse, they all have some sort of social boundary associated with them that is matched to the biological differences between varieties of apples. There is a social boundary drawn on top of a biological boundary. The clubs offer growers a new set of rules to operate within, along with new opportunities and constraints. Following an institutionalist framework, this paper will consider how clubs are a new organizational form that is a response to the current organization of the industry, but also an attempt to advance particular interests and identities. For breeders, clubs are a way to secure a funding stream and contribute to regional commercial production. For packers, club apples encourage a new way to organize the wholesale industry that maintains the centrality of packing while giving them more marketing power by enabling them to participate in branding. For growers, clubs advance an economic ethic of *varietal competition*, where varieties act like brands and economic participation changes. In each of these arenas, clubs advance interests and support identities.

Introduction

"Managed releases divide industry" (Fruit Grower News 2012).

"Can Club Varieties Revive the Orchard Industry?" (AgForInsight 2010)

These two news headlines illustrate the tension that underlies the emergence of *club* or *managed* varieties. They divide and revive. These new varieties are patented and associated with specific licenses that shape the ways that the trees can be accessed and the apples can be sold. In the US, clubs are relatively new, and as the headlines suggest, there are different opinions about what they can and should accomplish. There are disagreements about whether the clubs will hurt small growers, and create a new axis on which to divide the haves and have-nots. The SweeTango, recently released from the breeding program at the University of Minnesota, was the subject of an anti-trust lawsuit. The judge found in favor of the university and the club, giving the go-ahead for numerous other clubs across the USA. And while the clubs are contentious, clearly they are also appealing. As I have discussed in other papers, the clubs create social boundaries around varieties to gain control over the boom and bust cycles around them and resist the homogenization of the commodified apple, and they enable growers to expand a more creative and experimental grower identity by gaining more power over apple marketing. In this paper, I will take a broader look at the industry and describe how clubs are a renegotiation of power relationships in the industry, elevating the role of

wholesale-dependent growers in the process. They also advance an organizational principle or ethic of *variety-based competition*.

Clubs can potentially alter the relationships among economic actors in the apple world. They are an alliance between breeders, packinghouses, and growers, and change the relationships between those actors and their economic positions. Clubs also change the relationships between different types of growers by establishing a new type of boundary that is exclusive. Because the clubs are so new, their contours are not stable, but are being established in multiple different ways by different grower groups. However, they all reflect what is seen as the conditions of production, and their emergence and mobilization can be seen as a claim about how apple growing *should* be. That ideal of what should be is wrapped up with an effort to be competing through varieties. This paper will describe the different forms that clubs are taking, and consider them within an institutionalist framework that emphasizes how clubs influence the power relations in the industry more broadly. I will also highlight the ways that clubs, as a type of organization being mobilized to change the institutional architecture of the industry, are groups organized around *biological materials* and wrapped up in the material world of agriculture. In this sense they illustrate specifically a *biology of institutions*.

I will begin by reviewing the theoretical literature that I use to interpret and make sense of the emergence of clubs. I will discuss my own methods for gathering information about clubs, and the social and material contours of clubs. I will then discuss the context in which clubs emerge, paying particular attention to the ways that interpretations of the existing distribution of power in the industry is used to

shape the clubs, and how clubs may mobilize interests within those contexts. The clubs are particularly useful for a struggling wholesale industry, where prices can drop below the cost of production. I will finish by discussing how clubs coordinate industry actors in new ways that may alter the landscape of privilege and power, in part by social exclusion and the negotiating power it potentially brings, and through the advancement of an associated *variety-based* competition. I will also attend to challenges to those interests and resistance to institutional change particularly in the form of alternative narratives about the way the industry is organized.

Literature Review

This paper relies heavily on frameworks associated with the new institutionalism in economic sociology in an attempt to take a pragmatic approach that has materialist underpinnings. The old institutionalists of economics suggest that economic actors work with perceived opportunities and constraints, and orient their actions to conventions of practice and habit. Thorstein Veblen (1899, 1904) is often considered the founder of institutionalism, along with John R. Commons and Weseley Mitchell. Veblen wanted to build economic theory that accounted for the past and explained the cumulative aspects of economic change (Rutherford 1994, 2011). He was as much concerned with formal rules as with habits of thought and behavior that organize the imagination of an economic actor. He saw these formal and informal elements as related. One of the important themes of institutionalism is the relationship between structures and habits or principles. Commons (1931, 1934) further developed this particular point on the relationship between institutions and ideas by suggesting that policies can lead to social change and the

adoption of new approaches to action. He was explicitly concerned with how collective action was related to individual action. He defined an institution as "collective action in control, liberation, and expansion on individual action" (1931: 648). He used institutionalism as a particular form of political economy in mainstream economics. He also developed a theory of *volition* to explain institutional evolution. People are always looking to the future when engaging in actions, but not just a future in terms of the material outcomes of their actions, but a future set of conditions. They orient themselves to the social, structural conditions of action, or the political economy, rather than simply the contained, individualistic economy that's guided by the profit motive. When considering why clubs have developed, the institutionalist would ask what world, with what economic rules, are they trying to build for themselves? What flaws of the world are they trying to remedy?

The old economic institutionalists, such as Veblen and Commons, were describing an economic world that is largely propelled by economic purpose. People change the conditions of economic action based on a view of what they want economic life to be like in the future. Eventually the designs become invisible or nonexistent, and the actions become habitual (Bromley 2006). They become taken-for-granted justifications for what actors do, often after the fact (Boltanski and Thevenot 2006). In many ways, this institutionalist view parallel's Weber's discussion of rational action. Weber suggested that Puritanism spawned the austere form of rationality that would become the foundation of modern capitalism, in which technical and economic calculations become the foundations of survival, and

importantly, accumulation a testament to moral and spiritual worth (Weber 2004). While scholars have translated and interpreted Weber's *stahlhartes gehause* as the "iron cage" of capitalism, where one must accumulate to keep up, others have suggested that the structure may be more dynamic and malleable. The economy could be thought to consist of a complex of *institutions* that actors bump up against and alter with their actions, and those institutions are not rational and value-free, but laden with cultural values that privilege ways of doing things. Where Weber departs from the original institutionalists is his inclusion of culture and power. Institutions may be shaped without intention, or without economic intentions, but they are, regardless, embedded with intentions as they are molded to support actions.

The new institutionalism in economic sociology builds on these threads by emphasizing the ways that people change institutions to alter their relative position to other economic actors, and often includes a much broader definition of institutions than those that are more common to institutional economics. Nee (2005: 55) suggests that an institution is "a dominant system of informal and formal elements - shared beliefs, conventions, norms, and rules – which actors orient their actions to when they pursue their interests." When people change institutions, they are attempting to change the opportunities and constraints that they face in production, *relative to other people*. Club apples would be seen as an attempt to reconfigure the industry in a way that challenges rules that a group of people find unhelpful, and accommodates the actions and the principles that *they* believe would be more reasonable.

Changing the rules that govern economic behavior is not about making the industry better or more efficient for all economic players, and any institution inherently limits actions and privileges particular actors. But that is not to say that institutional change creates more constraint or inequality, and the institutionalists have traditionally been clear on this point. *The current institutional structure limits and privileges, and it is impossible to live in society without institutions*. It is not helpful, by implication, to think about institutions as an additional set of rules or burdens, or institutional change, a sinister, self-serving power grab. Institutions and institutional change redefines rules that already exist, whether formally or informally, and they it may involve a power grab, but that power grab may be grabbing power from somewhere it has been concentrated and redirecting it to where power has been previously inaccessible. Institutional change *is* about privileging particular actors and their resources so they gain a better relative position, but it is not necessarily a bad thing.

Bourdieu (2005) uses the concept of an economic field to describe the arena in which these institutional changes take place. The economic field is similar to a sports field. Movement in the field is governed by official rules and implicit principles, and actors have a sense of their position in relation to others. How the game is designed will influence the types of players that are successful. Those that are the most successful will want to maintain existing arrangements and are more likely to have the power to do so. People's whose values and interests are discouraged by institutions will want them to change. In the case of clubs, the institutionalist assumption would be that they should be a project exercised by

those feeling disadvantaged who want to capture a little more economic sunshine. According to Fligstein, (2001), institutional change is often attempted as part of an effort to gain security and stability. For apples, I will argue, clubs are an attempt to gain security in the wholesale market. I will suggest that clubs are an attempt by wholesale actors who are disadvantaged by the institutional structure of the apple industry, where generalized prices and standards are restrictive. They are trying to redefine the rules to favor higher quality, higher prices, and more power in the wholesale apple market.

Maintaining and altering institutions is political-cultural project (Fligstein 1996; 2001). While Commons discussed volition in the economy, whereby actors behave in ways that are consistent with their vision of the future, sociologists such as Fligstein have emphasized the ways that visions for the future are as much about cultural and political values and interests as pure economic utility. If existing institutions discourage the values that people hold dear, they may try to change them, but they may also believe that the status quo has a logical purpose or function simply because it exists. They may be confronted with forceful resistance from actors who benefit from current arrangements or have made investments based on their continuation. They may be part of the latter category themselves. When institutions do change, they do not change to reflect an amalgamation of alternative interests. They do not change in ways that equilaterally elevate actors who had been in disadvantaged economic positions. How they change reflects struggles between different actors, vying for new economic positions and resources, and some of those positions are afforded through new principles that would legitimate their actions.

Variety-based competition is one way that clubs are legitimized. Overall, they are a new set of rules that advance the interests and cultural ideals of groups in the apple industry, and others may see it as a threat because they have built their production around current arrangements.

In short, the economy is political, and institutional change, from this perspective, is the result of a successful challenge to existing hierarchies of privilege. Nee (2005) suggests that successful institutional change only exists when there is a shift in power relations. Club apples, as an attempt to introduce a new type of institutional architecture to the apple industry, reflects the cultural and political desires of breeders and orchardists as much as profit-making desires.

This paper will discuss whose interests these clubs benefit, whose power is being secured, and whose is being challenged. This research will address these questions, and in doing so, also illuminate the perceived contours of the industry that are being contested. The answers to these questions will be developed from the narratives that are told about the industry and the justifications for developing club varieties, as detailed in the following methods section.

This paper will build on the work on institutions by considering how materials are mobilized in efforts to change institutions. The relationship between materials and economic action is hardly new, although it has gained considerable vigor in the last decade with the emergence of science and technology studies, and the "materialist turn" in economic sociology, geography, and political science, where matter, in its various forms, is thought to matter, or be relevant. If the conditions of production result from the intentional architecture of institutions, then the

materials that are created to support that type of production are also embedded with those intentions. In previous articles, I've argued that the biological differences between varieties are being made more economically salient in clubs, and orchard landscapes are implicated in grower subjectivities (Legun, previous articles). This paper does not delve extensively into the biology of apple trees, but builds on that work by discussing how clubs, along with their biological aspects, relate to power and structure in the industry.

The ways these materials get built into institutions have important implications for the future. In his work on disputes over the failure of a metal pipeline, Barry (2004) describes how regulating the properties of materials can be a way to regulate people. Moreover, regulating the materials is often easier, and can more effectively fit into desires for economic rationality and discourses of predictability. Altering the *commodity fetish,* that is, the material object that represents social relations (Marx 1973), may enable a seemingly rational and swift improvement to economic life, but it masks the social changes that accompany the alteration. Developing a new type of apple that is sweeter, larger, and prettier may seem like a relatively obvious reaction to demands of the market, but it requires quite a considerable intervention in the relations that exist in apple production. Mobilizing an apple that is independent of these aesthetic characteristics is also meaningful, and carries social relations with it. Producing an apple that has been branded, as occurs with clubs, involves an intervention in relations and habitual practices.

This project departs from work of Marx's materialism in its consideration of how the apple is an actor, and its characteristics provide a platform for economic change. Robbins (2007) did something similar with grass, wonderfully illustrating how grass provokes a range of human behaviors in his book on *Lawn People*. He also described how the lawncare industry has supported particular types of relationships between people and their lawns, which in turn also encourages particular spatial organizations of houses, neighborhoods and neighbors. The behavior of lawn inspires behaviors that get institutionalized into the economy while also being integrated into a landscape. I plan to do something similar with apples, but apples differ in the sense that those growing the apples *are also* probably those creating a new organizational form in the economy. The role of the orchardist presents a unique opportunity to view the ecological foundations of economic institutions very clearly, and with relevance to an industry (food) that has largely escaped both contemporary research in science, technology, and economic institutions in sociology.

The incorporation of biological materials into an institutionalist reading of club apples will also help consider how non-human actors may disturb the rule-following and rational calculating of economic action. Plants can behave in unpredictable ways, and while efforts can be made to increase predictability and guard against ecological events such as disease or hail, their ability to conform to market principles is limited. People may have to buffer and manage this messy confrontation between plants and markets. It is also this messiness, this uncertainty

and forcefulness of biological actors, that may create the breaks in routine that provoke institutional change, hence the phrase, *the biology of institutions*.

Thus far, I have used my dissertation work to suggest that clubs provide growers with new types of economic opportunities and more power. In this paper, I will suggest that the power is not contained to growers, or generated from nowhere, but is situated within an industry. The power is gathered into the club through coordinating breeders, packers, farmers, trees and apples, and drawing a boundary around them. This repositions them relative to other industry actors who are not in the club, and changes power dynamics in the industry. In particular, it advances a wholesale vision of the apple industry, and gives those actors participating in that industry more leverage, and more movement. In the process, the clubs also advance visions of apple breeding, apple growing, and industry competition that are cultural, political, and economic. This paper will focus on the ways that clubs attempt to shift institutional rules to be in-line with ideals of economic participation.

Methods

The data for this article comes from interviews with growers, breeders, packers, and university extension agents. Many of the lines around these groups are blurry and unstable. There are a variety of different actors in the universities, and those working for extension services are in a different position than those in a breeding program. On the other hand, the university is a somewhat coherent institution that cultivates its own sets of privileges and constraints. Packers are

people that operate a packing line. They receive, sort, store, package, and ship apples. They are also often marketing and/or brokering the apples. That is, they are seeking out buyers, or they may be simply doing the packing when the grower has a buyer lined up. Many packers are also growers, or have been growers in the past. Many packers and growers have also been administrators for state agriculture organizations, and many have worked for university extension services. However, people would often take a position when they were discussing a topic like club apples and refer to sets of practices associated with one group or another, and so if a packer-grower was talking about marketing apples, I would consider their interests in that topic to be motivated by that role.

I had been attending workshops, sporadically, since 2009, and conducted a pilot study that year, interviewing four growers. While I was primarily interested in organics, some of the growers had brought up the concept of clubs as something more exciting and relevant for the future of apple production. Those that mentioned it had opinions, and described it as a remedy to the failures of the current organization of the industry. Prices of apples were always fluctuating, and inevitably falling below the cost of production. Nobody could plan for the future. Mid-sized farms were disappearing. Rule making and rearranging the social relationships between farmers, in the form of developing clubs or managed varieties, was a way to address these problems, or so it was suggested. The narratives farmers were giving sounded so clearly to be an example of the type of institutional change that I was interested in: the renegotiation of rules to advance particular interests.

I was primarily concerned with the ways that growers and other industry actors situated the development of clubs within a narrative of apple production. I conducted thirty-seven interviews with growers and seven interviews with breeders, marketers, and university extension agents, for a total of forty-four interviews. Nineteen of the growers were participating in a club, and six of the growers also ran a packing line. Twelve of the growers were involved primarily in direct markets, while fourteen were heavily involved with wholesale markets. The remaining eleven were actively involved with a variety of markets. Interviews lasted between one and two hours, but could extend up to four or five. I was frequently revising my questions as I went along to clarify information or recreate a line of questioning that had shown to be highly enlightening in a previous interview.

While my interviews were open-ended, I asked all growers why they did or did not grow club apples. These explanations or justifications often spiraled into comments about particular actors in the industry, economic relationships, environmental constraints, or simply the value they attached to the variety itself. They were often implicit or explicit statements about the way things were or how things should be. I tried to focus on these narratives and use them to develop a picture of the apple industry as a field that actors respond to and create.

On occasion, I told the people I was interviewing about something that had sparked my interest, or some thoughts I was having about the project. I generally tried to have these conversations towards the end of the interview, but I approached the interview as a dialogue rather than the extrapolation of information. In conversation, the architecture of the industry could be built by my questioning

about its specific contours and the participants efforts to discursively explain it to me, from their position. The interviews were a product of two standpoints, as Donna Haraway (2003) would suggest, meeting and developing ideas, and I tried to use my sociological background to focus on those areas that I thought would be most relevant for developing this portrait of the industry. I also tried to incorporate methods in institutional ethnography, and particularly the work of Dorothy Smith (2005) who uses the methodology to describe the ways that everyday practices are practices of institutionalization. She suggests that actions can be usefully framed as interpretation and activation of institutions, I will be incorporating institutional ethnography in the research by considering how research participants draw on economic principles, regulations, and cultivation norms in framing their actions. Along these lines, I focused on justifications for actions, and particularly those that referred to other industry actors like packers, retailers, or consumers, or institutions like grading standards and pricing systems.

I also allowed for as much flexibility as possible in letting the participants identify what they thought was relevant for my project. At the end of each interview, I would ask participants to tell me anything that they thought I should know. In multiple cases, this turned into a moment where growers would bring up more explicitly political sentiments about clubs or the problems in the industry that they were responding to. In some interviews, regardless of how much I probed and asked for further explanation, these emotional responses would be hard to generate in the parts of the interview that I led. Some of the most important aspects of the interview were not answers to a question, or explanations around an arrangement, but

seemed to be more of a reflection on how the growers thought of themselves in the industry. While I tried to generate as much discursive freedom as possible, without completely drifting away from the project altogether, I was certainly active in guiding the conversation. That portrait as it emerges on these pages is clearly a reflection of what I have imagined when speaking to them and how I decided to textually represent it.

The Contours of Clubs

Clubs are a product of patent law, trademarks, variety distinctions, technologies, and social organization. They are legal, economic, biological, and social. When a new variety is created, it is often patented. The person that found the variety, or bred the variety, is allowed to gain an income stream from the sale of the tree. Patents on apple trees run out after twenty years. According to the three breeders I interviewed, when a new apple variety enters the market, it is not unusual for the apple to become popular just as the patent is running out. It takes at least four years, even in the more modern orchard, for a tree to become productive, so there is a slow uptake. It trickles into local markets and gradually builds momentum. Trademarks, on the other hand, can last indefinitely.

By turning varieties into property, the patent holder can decide what rules can govern cultivation and sale. The legal architecture of intellectual property for new plants preceded club varieties, and provided an entry point into giving more social definition to biological differences. In general, all clubs have some type of restriction associated with them, so there is a socially imposed boundary around the

material boundary of the variety. Elsewhere, I have discussed extensively how distinctions between different apple varieties are biological and social, and have created the differences that can act as cleavages between groups of people. While varieties are different, they depend on grafting for reproduction, so that every Red Delicious apple tree is a clone (or a clone of a clone) of the original. Differences between apples trees are many and occur naturally, but varieties do not: they are cultural product.

The biology of the apple, in this way, participates in the formation of clubs by having material differences that depend on social relations for their maintenance. Varieties are necessarily biological and social, and clubs are simply a stronger, more explicit, exclusive form of those social relations. In some sense, all varieties have an aspect of social exclusivity because their access is dependent on a source, be that source a nursery or a neighbor, an no access to a source is going to be perfectly equal across a population when the acquisition of a tree depends on money, information, and the means to transport the wood from one place to another.

Clubs are also a product of socio-economic landscapes. Growers have an increased ability to generate large quantities of apples for a market on smaller plots of land. The time it takes for the trees to become productive has become faster. Modern apples are grown on a highly productivist-oriented landscape, that's material design is supporting an institutionalized logic around generating a lot of apples while also being responsive to the market. The smaller trees mean that it's less risky to plant new varieties because the investment of planting generates a profit quicker. It also helps growers produce larger redder apples that are more

uniform. This landscape is particularly supportive of a wholesale operation, but one that encourages intervention and collaboration among growers.

I have discussed in more depth the emergence of clubs in the context of material and technological changes in the industry, and suggested that the biology of apple production plays a role in shaping the strategies of farmers. I should stress that there is nothing inevitable in the formation of clubs or the outcomes. There are different forms that the clubs have taken, and while they reflect the cultivation of trees, commodities, food, and landscapes, they also cultivate power relations. This paper will focus primarily on the ways that power relations are part of clubs, and how they reflect, reproduce, and alter the existing institutional architecture of the industry to advance interests. I will also continue to highlight the ways that materials are being used in the process, and landscapes are being mobilized and altered.

Clubs are an institution. They are a set of rules that people orient their actions towards when they are engaged in the various activities of apple production. Those rules are new, and they vary between clubs. In the Midwest, I encountered three different clubs that had been or were being formed. They varied in their degree of exclusion, the extent of grower participation, marketing rules, and the financial burden of participation. Below, I have included a table that described the clubs along various characteristics. It should be noted that all clubs are formally co-operatives. This lets growers discuss price and collaborate on the marketing of the apples.

Table 1: Different clubs and their characteristics					
Club	Developers	Access	How they are sold	Investment	Grower participation
A	University	Restricted to 40 growers	Set markets and packinghouses	Commit to number of trees and per tree, per year and apples sold	High
B	Grower/breeder & packer/grower	Restricted to a set number of trees	Set packinghouses (unclear)	No minimum trees, pay by tree per year	Variable (relationship-dependent)
C	Grower co-operative	Membership in co-operative (open access)	Any markets – no restrictions	No minimum trees. pay per tree, per year	Low – variable (grower dependent)

There are endless possible rules that clubs could develop, but in general, they differ in the degree of exclusivity, how tightly controlled the apple sales are, the level of investment required, and the degree to which growers can participate in the club rules in an ongoing way. Institutionalism would suggest that each of these dimensions is a reflection of how the architects of the clubs see the industry and how the industry should be in the future. Claims about how the industry should be organized are also claims about whose interests should be honored and what practices should be privileged. They are also claims about what existing conditions should be protected. In the context of clubs, these questions can be approached by

looking at the groups involved in the formation of clubs and what they stand to gain by the emergence of clubs and the institutionalization of specific rules.

Breeders & Privatization

There are two streams that flow along the privatization narrative. The first, which I will discuss below, is about the increased privatization of universities and the pressure they are under to secure private funding for their programs. The second is about the industry, and maintaining a "public good" narrative despite the reliance on privatizing apple varieties. This second narrative is perhaps the most neoliberal moment I encountered in my interviews, as it demonstrated so clearly a market mentality whereby privatization and the new forms of competition that accompany it are a good because they benefit the industry overall, not just the club participants. I do not doubt that there is some truth to their position, in that the clubs do allow for a type of informal regulation to emerge that is driven by growers. On the other hand, from an institutionalist perspective it shows that some rules, namely the decline in public funding and the principle that private goods hold public benefits, are being incorporated into everyday economic life.

I spoke to several university breeders. There was only one type of club I encountered that emerged from a university program, but it is significant because it was the first club that emerged in the Midwest, and generally people related to it as a prototype to which they could respond. It also provided a model that is being taken up by a number of other universities across the United States. Growers often

offered narratives that collaborated the claims made by breeders about the role of the university in the development of clubs.

Universities have been experiencing significant funding cutbacks. At a recent meeting of the International Fruit Tree Association, a plant pathologist from New York turned the focus of his presentation to the changing societal context of apple production. It was a morning session of the first day, and the room was full of apple growers from all over the US. It was a predominantly male and white crowd, but the ages spanned from early twenties to late seventies, if not older. I sat beside two young women, one of whom I had seen at another apple conference in August. She noted that I had found myself in a cluster of New Yorkers (the next day I found myself amidst a grower gaggle from New Brunswick). Four rows ahead of me, a man had his arm draped across the back of the chair of another man. The presenter talked about changing food climates, and increases in anxiety. He talked about reduced funding for universities, fewer plant pathologists in the United States, and a need to increase reliance on private businesses that perform the types of tasks traditionally associated with universities. I may have been imagining things, but the room seemed to tense during his talk. Draped arms were removed from chairs and people tilted forward, away from the colleagues and towards the front of the room.

Land grant universities engage in a number of activities with growers. They organize field days, respond to growers questions, and breed new apple varieties. I went to several field days that were associated with university extension programs. One was organized around spraying technologies, the other pest management, and another on introducing wild grasses to orchards to encourage wild pollinators and

predator pests to live there. Many of the growers would talk to each other and problems they were seeing in their orchards, but sometimes they could not resolve their issues, and would be visited by a university extension agent, or send in a sample to a university lab. Many of the growers I interviewed mentioned that they had sent in a sample of pest damage to a university specialist at some point. Universities also participate in the development of new varieties, and historically those breeding programs have played a role in marketing regional apples. Universities have historically played a significant part in the apple industry, and in many ways, continue to do so.

Many of the land grant universities have been receiving funding cuts and have been encouraged to secure income from private sources. One of the ways they have been doing this is by capitalizing on patents, and apple breeding is no exception. The breeding programs take considerable resources to maintain. Take, for example, a breeding program I visited in the spring of 2012. I sat in a large office in a one level building on the outskirts of a large city. The room was adorned with posters advertising varieties born of the program, and these posters I would also see on the walls of packing lines and farmer offices throughout my research. I asked Bill, an apple breeder who had been working at the breeding program for over thirty years, how they developed a new apple variety. He explained how long it took to breed trees, and how much labor went into developing a variety.

> K: How do you develop a new variety? You mentioned it takes a long time.

Bill: It all begins with the flowers and basically we take pollen from one tree and put it onto the flowers of another, and use hybrid seeds from that. Then we take those seeds and we grow those first in a greenhouse, and then eventually in the field, and there are things we've done along the way that speeds that up. About 15 years ago we switched to taking those trees and grafting them onto a dwarf rootstock that makes dwarf trees. It speeds up that process, so now when we do that we can start seeing fruit after about the fifth year. At any rate, we have thousands of these trees out in the field and once they start bearing fruit, then we've got to go through and taste them, and sort out the good, the bad, and the ugly. Most of those fruit aren't good enough to go on. They get thrown away and so, once that process begins, I'll be tasting sometimes five to six hundred apples a day. That goes on for two and a half months, and at the end of that season, I will have thrown away somewhere in the neighborhood of two to three thousand trees that weren't good enough. I will have found somewhere in the neighborhood of ten to fifteen trees that were good enough for further testing. And, once those ten to fifteen are found, they get assigned a number, a test number. The original number was number one, and it was 102 years ago. *A hundred and two years ago*. Now I think the next one I numbered was 2087, so we're about 102 years old here and in that time, 2087 selections have been

> made. Once those numbers get made, then we'll clone four trees from the original tree. Then I'll start evaluating them very closely."

As demonstrated by the quote, Bill took a considerable amount of time to explain to me how laborious the breeding work was, and how long it had existed. He showed me a set of binders lining the walls of his office. They were short and long, and inside they had sheets of paper—at least one for each tree. There would be a list of characteristics on the left, and a series of years across the top. Bill would go through and rate each tree annually based on characteristics. There would also be annual taste tests, and each would be given an average score. If a tree didn't make the grade, it would be removed from the orchard.

Bill also described how the commercial orchard landscape would be incorporated into their tree selection process.

> "There's about 20 different characteristics that I look at every year, but it's in a very crowded situation and we really want to see it now in more of a commercial orchard setting.... We treat them just as though an orchard would treat them because that's how they're going to be grown and evaluated ultimately."

Bill is describing how trees get chosen for a market. They have to be placed in a particular environment to see if they behave like commercial trees. It is a process designed for the industry, and the selection of varieties has a lot to do with the vision of the market the breeder incorporates into evaluation. Apples are evaluated for pressure, color, sweetness, crispness, and a variety of other qualities. Breeding programs do have a degree of power in the industry by having control over the

application of market desires into variety selection. It is this incorporation of the market into the breeding program, including the very material aspect of varietal selection as well as varietal management, that becomes a foundation for the moral project of apple breeding. This project is much more calculative and about the release of varieties than simply producing good trees.

There is a change in the everyday practices of breeding as a response to shifting institutional contexts, as exemplified by Bill's comments below where he discusses the changes in his role.

> K: How has your job changed since you started working with apples?
>
> Bill: Well, certainly when I started it was like 100% horticulture. It was all about the horticulture, and now my job is at least 50% sitting at this computer and it has to do with the management of our varieties and our would-be varieties...it's gone from horticulture to intellectual property management. It's not things that I went to school for either, but that's fine. We've learned what we needed to and we just try to stay up with the curve, which is constantly changing.

As I discussed elsewhere, apple varieties follow a boom and bust cycle and growers are often concerned with staying ahead of the curve from a marketing perspective. The economic life of the variety is integrated into the breeding program. This involvement with the tree after it is created and released is a central feature of the new breeding program ethic. Take, for example, the problems Herb, a breeder from a private institution identified, using the Honeycrisp as an example:

> "The other issue that kind of drives us, let's take Honeycrisp as an example, is that everybody can grow it, anywhere they want. The only requirement is you have to buy a legally propagated tree. So now, because that tree has a lot of momentum, people know the price is good, people are planting it everywhere. And some of those places are not suitable for it. It's a fussy tree. If it's not grown in the right conditions, the fruit it produces is not as good, and yet every one of those fruit still get the name Honeycrisp. At some point people start saying, "I'm paying three dollars a pound for this thing. It's not that great!" Well that's not the fault of the variety. That's being in the wrong area, poor quality control. In effect what happens then is the variety loses market share just from poor handling."

The patent means that breeders continue to be actors in the life of the apple, even after it has been released. They receive royalties for it, and the name of the breeding program is attached to the tree. This is a new role for apple breeding, where they are implicated in the success of the apple variety. It necessarily increases their role in marketing and justifies their intervention in the ongoing life of the variety. The lack of growing and marketing control foregrounds the moral character of club apples because the declining quality of the variety and its subsequent economic failure is seen as a bane to the industry overall. Solving this problem by attaching rules to the patent can be seen to alleviate these harmful boom and bust cycles.

On the other hand, there are real economic benefits to the clubs for breeding programs. As more of their income depends on royalties from patents, they have less time to wait for varieties to become popular. For example, just as the Honeycrisp apple became the hot new apple, the patent ran out, so the university missed a high-income stream by a few years. With managed varieties, there is a buy-in that immediately streams back to the university, and the trademark on the name of the variety lasts much longer than the patent, so that even after the patent runs out, they still have a source of income.

The emergence of clubs and the entrance of the university into a more competitive economic environment has influenced the relationship between growers and universities. Many growers suggested that it was inappropriate for public universities to be participating in a club that was so inherently exclusive. Russell, for example, was highly critical of the university's role in the development of the Honeyrcrisp, and particularly in the ways that they cited a lack of boundary around the variety as a problem. This boundary and the arguments about its necessity are part of the variety-based competition I will be discussing later in the paper.

> "I understand where they're coming from. Universities are being choked everywhere. They're hiring lawyers and assistant deans for finance. They're hiring people to raise money on patents, on everything the university can squeeze money out of, so they sold exclusive distribution rights to an orchard, and in return they wanted royalties on both of the trees but also the fruit itself. Ok, so we have

> this managed variety and the farmers have to buy in. it's about a $200,000 minimum, because you have to buy 20 acres worth of trees, and stuff like that. Alright. People involved with the variety have gone around saying bullshit to defend the university's role in this. They've has said stuff like "there's no vested interest, the thousands of growers, packers, and shippers, who grow Honeycrisp." I can't speak for thousands. I can speak for myself and I certainly hold a vested interest. Like growers don't have a vested interest in growing Honeycrisp? They've vested their space, their labor, and their money to it."

By tying themselves to a club, the university is changing their economic relationship to growers. They become actors in the life of the variety, and the variety becomes the vehicle for a new form of competition, *variety based competition*. Clusters of industry actors are enveloped in the success of a particular apple variety, which behaves as a brand. One of those actors is the university. As a result, universities become competitors to growers who are not affiliated with their brand. It is not to say that the university becomes a hostile competitor, or that the competition is necessarily bad, but that their economic investment in a variety so that their economic health is dependent on its success makes them stakeholders in the brand, and competitors to growers who are not members of the clubs. Several of my research participants expressed discomfort with the shifting role of the university due to the advantages that years of public funding had provided.

The emergence of club apples also complicates the relationships between university extension, and other public institutions like state marketing boards, and club apple producers. One person who worked for extension services suggested that he felt awkward providing pest advice to growers who participated in a club, because the club had their own program for dealing with growing issues. He also said that spending time on a problem particular to a variety that could only be grown be a small fraction of the growers he worked with would be a misdirection of public resources. Similarly, a grower I spoke to said that he urged his marketing board to exclude the club varieties from their program, because they have their own marketing and any marketing efforts should be concentrated on those regional varieties that all growers have access to. In short, the club model creates problems for public institutions by encouraging them to become private – serving only particular segments of the population.

Packers and Mid-Sized Growers for Wholesale: Real Growers, Threatened Growers

There are a variety of different types of packinghouses. For the purposes of this paper, I use packers, brokers, and marketers interchangeably. In the Midwest, a packinghouse often brokers the apple, or finds them a retail market and coordinates apples coming from bunch of different orchards. Some growers have a packing line on their orchard where they also packed the apples of other people in the region. Other packing lines were focused solely on packing and marketing apples, and had no orchard component at all. The types of relationships people had with packing houses differed considerably depending on what type of packing line they were

dealing with, and what sort of relationship they had with the people running the line. Growers often had very different experiences with the same packinghouses, and to some degree, their relationships seemed to depend on the type of operation they were running.

In particular, the market power of growers, in their relationship with packinghouses or brokers and wholesaling apples, was tied to their size. When the packinghouse is very large, but the orchard is small, their activities have such little impact on the health of the wholesale operation, and as a result, they have less control. I asked Chris, for example, what relationship he has with the packinghouses he works with. "We're sort of in communication year-round," he said. "They want to know how our crop looks. They want to know what they can count on us for, and what they basically need to outsource to Chile and other places because, um, you know, the packing-houses— their reach is pretty far and they don't really need the local crop. It's nice of them to include us, because it helps us get our apples distributed locally, but we are such a drop in the bucket." Throughout the interview, he described his relationship to the packinghouse as one where they were doing him a favor. The focus on favors illuminates the unequal distribution of economic power between grower and packer. Chris also expressed frustration at the pricing system, where the price the grower would receive for the apples would only become clear once they were sorted and sold. Growers like Chris would send the apples to the packinghouses, and receive a packing slip weeks later telling them how much they earned. Some growers told me that they had fallen out with specific packing houses because they felt their apples had not been sorted and priced fairly. "Are you

ever surprised by your packing slip?" I asked Peter. "Well, it's never more than I expected," he laughed. "I have been disappointed." Some of these disagreements would create long-standing rifts.

Packing-houses have their own constraints, and despite the advantages of their structural positions, they also are dealing with a relatively small number of retailers, and prices that they have little control over. Ted, for example, was a grower who was also involved in brokering apples and said that, while he has some decision-making power, its highly limited, and much more limited than growers are aware of. He has little control over price. "I'm the one that's making the decisions on what the pricing's going to be and everything" he says, "but actually it's dictated by supply and demand, and you know there's a boat load of Red Delicious then you know you'll only be able to get X amount of dollars for Red Delicious. Your portfolio of customers, some customers are going to pay more and there's going to be your lower end discounters that are going to want it for less. So you have to manage, you know, your customer base and sometimes your customer base changes depending on what happens," he sighed. "Somebody may go out of business." Ted was an incredibly nice, energetic grower, committed to the economic vitality of the Midwest wholesale industry, and clearly took no joy in farms disappearing. Having farms in competition with each other means that selecting one grower's Red Delicious over another's can be devastating.

Despite their constraints, packinghouses do exercise a fair amount of power in the apple industry by nature of being in a structural position to make decisions, and also because of their connections to markets. They channel apples to one

customer or another, and shoulder less of the risk than growers, but they are also unable to actually affect the market. Moreover, many of the packinghouses are run by growers, and committed to a particular wholesale idea of farming and apple production. They are invested in the success of a wholesale industry, and the success of midsized growers in a region that has struggled to compete with larger orchards in Washington. I cannot recall how many times I heard growers in the Midwest refer to themselves as a "drop in the bucket" compared to Washington State.

Club apple varieties involve packinghouses, in part because packers have the skills and connections that can aid marketing for retail. Although it may not hold true for all clubs, many of the industry actors I spoke to framed them as a project designed particularly for midsized growers dependent on a wholesale market. Grant, a grower and packer integral to one of the Midwest managed varieties, positioned the club as a wholesale project, distinct from the growers who predominantly grow for a direct market. "Again, the direct market folks have wonderful opportunities. They'll do fine, they can survive." Many of those who sell predominantly to direct markets are situated close to urban centers or have access to a popular throughway. They have a geographic advantage, and receive greater returns on their apples as a result of direct sales. "My constituency tends to be the full time commercial grower," he continued, "whose goods end up in the grocery store. And these guys, we guys, are getting the hell beat out of us. This is a chance for us to own part of the brand equity if we do everything right and hopefully sustain it longer." Grant and other growers are using the clubs to hold onto a specific vision of

apple growers that is commercial and for a wholesale market. This process relates to the idea that growers are cultivating their identities, as Bell (2004) describes, but that those identities are also being cultivated around materials, such as apple varieties, and mobilized into the fabric of institutions.

It is particularly interesting because many of the growers I spoke to suggested that wholesale was the least profitable aspect of their operation. One grower even suggested that, while they sell 70% of their apples wholesale, they receive 90% of their profits on the farm. On the other hand, even growers who were frustrated by the pricing systems and their vulnerability in the wholesale world, mentioned that having a wholesale market was integral to their orchard. Many of the growers were producing much more than they could possibly sell directly, and the wholesale market would soak up some of the extra and generate an income. As Chris, quoted earlier, mentioned, having an outlet for extra apples was better than nothing.

For those who are fully invested in wholesale, the packing-house as a dumping ground for excess supply would be unappealing. Wholesale should be a profitable option for growers. “We tried to sit down and look at all the contributions to the value chain from the time that the variety is invented until the consumer gets it.” Grant was explaining the conception of the clubs to me. “Who all does what, and what is that worth today? And what does it seem like that should be worth in a better world?” This reference to a better world being a great example of the volition Veblen referred to. “Retailers command an overwhelming portion of the total cash flow of the thing, and I’m not necessarily begrudging that of the retailers, that’s a

business that they are in, but as you look at how the rest of us get paid, you can't help but say, what can we do here to bring a little more equity to the value contributions through this whole chain?" On the other hand, it is unclear to what extent discourse about retail power perpetuates the unequal power imbalance. Some growers rejected this dominant narrative, and skirted the conventional wholesale system to varying degrees. These direct wholesale relationships are difficult to cultivate for growers. Doug explained to me how the relationship between growers and retailers had changed. "20-30 years ago we would have a produce buyer from a retail distribution center, from a grocery store chain actually come up in the fall. He would walk through the orchards and look at the crops, and we would visit with them and it was definitely a face-to-face kind of relationship we would have with the buyers. Now with consolidations and mergers and bankruptcies we've gotten to the point where, to talk to the buyer, for instance, we would call Dallas, or some place in Florida. I mean, we would never have any face-to-face meetings with the buyer, and their only interest was price. They're say, ok, fax us a price sheet." He said that they would be unable to offer the consistency or varietal mix that the retailers wanted, so he had to form alliances with other growers and sell together. Connor, a large grower who also ran a significant packing line, made similar claims. "There used to be a lot of smaller chain grocery stores," he said, "You know, 20, 30, 40 stores, so there was a lot of competition as far as buyers around. They bought locally because their stores are local, and their managers are local. Now the buyers for these stores are, you might have a produce buyer that's in Texas, so he doesn't hear about people from the store. He doesn't care." What these

comments suggest is that retail conglomerations necessitate packinghouses and more aggressive marketing. Their purchasing needs exceed the supply of a single orchard, and growers interact with much fewer possible retail outlets leaving them with less power, and less of the food dollar.

Despite the assumption that direct marketing was on-site, farm-stand, or farmers-market sales, three of the growers I interviewed did sell directly to large grocery stores. They had little interest in the clubs, and did not see them as a threat, nor did they have any real problems with the current organization of the industry. These narratives contrasted the one I often heard about the struggles of wholesaling and the need to develop a club with more aggressive marketing. Others were producing for a direct market, and while some had knowledge about clubs, others were completely disengaged. These participants demonstrate that narratives about unreasonable competition and the stress of the commodity chain are not fully accepted among growers.

Growers who accessed a wholesale market but did not use a packinghouse had much less interest in the clubs, and were often removed from the broader apple producing community. Ray, an 87 year-old grower running a 100 acre orchard had very little knowledge or interest in the new, club varieties. In his operation, workers picked apples directly from the tree, boxed them, and sent them to a popular, up-scale retail chain, and he specialized in antique varieties and organic production. Another grower who sold directly to the local stores of a large retail chain asked me to explain club apples to him, having never encountered the concept before. Another grower was familiar with club apples, but much more interested in his own

operation and participating in local educational programs (he frequently had high school and college students on his orchard looking at different bugs and pest management practices). Growers, who had unique relationships with a market and were not going through a packinghouse were a little less likely to be interested in club apples, even if they were participating in a wholesale market. There was also a significant portion of direct marketers who were completely unfamiliar with the club varieties, or knew about them, but had so little interest in them that they had nothing to say about them at all. Clubs are much more important for packinghouses and growers who sell wholesale through them.

For packers, brokers, and marketers, clubs can be seen as an attempt to revive the commercial industry, given constraints or perceived constraints. While they remain an important feature of commercial markets, packers cannot survive without commercial growers and they also benefit from the extra income of a high priced variety. Moreover, a profitable version of commercial production is integral to the maintenance of particular types of grower identities that are founded on an idea of food production, as distinct from styles of growing that draw more income from hospitality or agri-tourism.

In the Midwest, there are many different types of growers. One aspect of production that I was surprised to learn about was the diversity in the types of markets growers were participating in. Sure, some growers were predominantly involved with wholesale, or some entirely focused on direct markets, but most growers fell somewhere between and had developed highly innovative ways of selling apples and products that could accompany apples. Growers were involved

with donut production, hard cider making, event hosting, school field trips, grafting workshops, and tree sales. One grower had been leasing trees to families for generations, where they could engage in the various seasonal events and harvest the apples at the end. Other growers were involved with holding onto old varieties, or using the orchard as part of a therapeutic program for people with cognitive disabilities. Others had decided to plant an orchard as part of a retirement project, but even within the hobbyists there was a great diversity of operations, and certainly many growers who had gone into growing post-retirement were participating in wholesale and completely dependent on the orchard income. In short, there was an incredible range of orchards and markets, but clubs maintained a strong wholesaling flavor.

Variety Based Competition – Branding

Not everyone I spoke to grew club varieties, or liked the club varieties. Those who had a more pessimistic vision of club varieties tied it to the emergence of competition based on varieties, or branding apples. Once there is an exclusive group of growers organized around a variety, cooperatively managing the economic life of that variety, they are becoming a brand that can compete with other brands. The vision for the club apple market would be that the market would bear a selection of club varieties at any given time, and these would all be high quality apples that could increase the number of apple consumers.

Many of the growers who were invested in the club varieties considered branding to be a way to compete with snack foods in the grocery store. For example,

Doug, a wholesale grower involved in a club, made a typical argument when I asked him to describe his competitors: "I don't think other apple varieties, or other apple growers. I don't think citrus growers are competition at all. They all enhance our business. For the snack food trade it's people like Frito-lay and soft drinks and cookies, are our main competition." High quality produce on the market would be a boon to their operations and the vitality of apple sales. This ethic of producing good apples to elevate the status of apples overall was common.

On the other hand, when I asked Doug to explain his strategies for competing with snack foods, he gave a very brand competitive answer: "Well, the strategy is to try to sell apples that taste good, that kids or moms will want to buy in lieu of potato chips. That's sometimes sort of difficult to do because salt and sugar and the processed food is very attractive to kids. That's one of the reasons why we have been so excited about these two recent varieties that we've taken on because we've had many retail customers tell us, "my kids didn't eat apples until they ate a Honeycrisp, and now it's all the apple they'll eat, the Honeycrisp" so we see that as making inroads into our competition of Frito-lay kind of snack foods." The new varieties he is planting are intended to do the same thing as Honeycrisp: win people over who *wouldn't otherwise eat apples, but will eat these particular apples*. This was not an uncommon sentiment among growers. When these varieties are exclusive, unlike the open-access Honeycrisp, varieties would be competing for consumer taste buds in a way that places growers in competition with each other. This narrative about competing with other snack foods is also a construction of grower identities, where they are promoting healthier food options in the supermarkets and

bettering the market for everyone through the production of a *good apple*, that can and should be distinguished from bad, less desirable apples, be it from their lacking flavor makeup, or lax handling.

The efforts to produce a consistently high quality apple also resonates back to claims made by breeders about the public benefits of a private apple. It almost echoes the old trope about a bad apple ruining the bunch, but reversed: a good apple benefits the bunch. While to some degree this may be practically true, what is particularly interesting is the way that the trope gets reproduced in a way that necessitates social closure around a variety rather than efforts to reduce the pressure to overproduce or undersell apples in a way that diminishes their quality.

Focusing on exclusive varieties, or *brands*, as a means to achieve competition with other snack foods is also considered the introduction of a new form of competition among other growers. This variety-basic competition narrative emerges in a number of ways. Firstly, some have suggested that there is not limitless market space, so that the success of some varieties is going to necessarily limit the success of others. Secondly, in some cases growers are unable to sell club apple varieties to each other. Wholesaling between growers is a fairly common practice and closing those markets along variety lines is a change to the structure of competition. Growers often disagreed about how much these two factors would affect the success of club apples. The growers that believed that the organization of the industry would lead to a failure of clubs were mobilizing a counter-narrative to the varietal competition ethic that is being mobilized by clubs. It is a claim about the

way that the industry *is*, but also a suggestion that these features that discourage clubs are good and should not be pushed aside by the new forms of organization.

This varietal competition way of organizing the industry was demonstrated through claims about the number of varieties the market could bear, as though one's popularity would necessarily threaten another. "There's only so much shelf space," several of my interviewees suggested. There were also comments about whether the Honeycrisp would be replaced by new varieties, as the increased planting of Honeycrisp would lead to price pressures that push the quality of the apple down. The price would lower too, and soon, everybody would be looking for something new. Clubs are trying to be part of those new apples, and make sure that they stay profitable for longer. Two growers I spoke to also suggested that new varieties were being touted by club participants explicitly as a replacement for the Honeycrisp, which created a significant stir among growers. Brent, for example, thought the SweeTango would fail because its proponents had placed it explicitly in competition with the Honeycrisp. "In Michigan there were 17 people originally." He's referring here to SweeTango growers. "I don't know how many are licensed overall to grow it. There's 950 apple growers in Michigan, almost all of whom grow some Honeycrisp. Then they market themselves as an improvement over Honeycrisp. Well, when that happened, the university now is dependent on this thing performing, but created enemies, or hostile competitors shall we say, out of the 933 growers who are not a part of the deal."

Even those participating in the club were anxious about claims that the new exclusive varieties would replace the Honeycrisp. For those who grew it, the

Honeycrisp was their most profitable crop. While many were anxious about the future of the apple, they were also interested in its success for as long as possible, and nervous about anything that would threaten it, including new varieties. Other growers who were excluded from the clubs expressed anxiety about being cornered out of the market. As the new varieties become popular, retail chains and packinghouses will demand them and drop the growers who cannot provide a supply. This was primarily a concern among growers who were dependent on a wholesale market, and less so among those that were engaged in direct marketing.

Some growers challenged the argument that the Honeycrisp would be declining in popularity, and generally resisted the narrative of varietal competition by suggesting that there are multiple markets that can be accessed to buffer against inelasticity. In this story, growers can send varieties to the markets that they find most profitable or appropriate, and there is no finite, static demand that will be reached. The opportunities to sell Honeycrisp are not going to run out anytime soon, and as a result, growers will find the clubs less appealing over time because the varieties that are open access will prove to be profitable, easier to grow, and easier to manage. This argument was most strongly articulated by growers who were critical of the club model and saw it as threatening, but also by those who wanted to suggest that the club model was not going to accomplish anything significant in terms of restructuring the industry. For those who used the latter argument, they often were not strongly opposed to clubs, but saw them as a non-threatening and largely insignificant. They are unlikely to catch on and dominate the industry,

because they will be unable to compete with the low prices of widely produced commodity apples, the traditional foundation of wholesale markets.

The competition between varieties in the clubs complicates informal markets among growers, and some suggested that the chance of losing those markets would make clubs less desirable to growers. Many of the growers across the industry spectrum had relationships with one another, and shared information about successful aspects of their orchards. They would also share apples between each other to buffer against supply-demand mismatches. When one grower ran out of Honeycrisp, but had a good market for them, she might call up her neighbors and ask whether they want to sell her some apples. In times of extreme climatic disruption, such as the early spring and late frosts of 2012, growers may get together and optimize their collective crop. Many Midwest growers lost 90% of their crop in 2012, and some formed a group to work together to decide how to sell the remaining apples. Growers have adapted their economic practices based on the existing institutional rules, and changing those rules so that those practices become discouraged was distasteful for some.

By forming closed publics around a variety, that sharing is challenged. They often had rules around whether the apples could be sold wholesale between growers, and in one of the cases, the practice was against the club rules altogether. For the other two, the price of the apple would be agreed on by the cooperative, so deals between growers would be complicated, and the prices of the apples would have to remain high. The materials become a source of exclusion and distinction. Varieties released from the University of Minnesota and Cornell University would

have a restricted release for commercial growers, but could be accessed by anyone in the state for direct market. Other club varieties would include a set amount of trees, and everyone could apply to grow the variety, but their access would depend on the number available. One variety recently released in the Midwest can be purchased by anybody, but the grower must become a member of the cooperative managing the variety and pay a small annual fee along with royalties and a per-tree annual fee during bearing years. Even as a "managed open release," the club varieties necessarily create associations organized around an object that is going to distinguish between growers, although the creation of a managed open release is also a comment on the emergence of closed release varieties.

Arguments that challenge the appropriateness or coherence of the club model are performative. In particular, those that suggest that the club is not successful, and unlikely to be successful, is a comment on the desirability of a variety based form of competition between growers. It is a comment on the reasonableness of the closed club model in the rules it tries to renegotiate. It not only reflects an opinion about club apples, it also suggests that the varietal competition ethic is not compelling, and not an effective or powerful way to structure the industry. Those that think the clubs will fail in these ways are also suggesting that alternative sales, like sales between growers and direct markets, will be and should be more economically vibrant than wholesale markets. If power for growers, packers, and breeders in a wholesale-retail environment is at the expense of actors invested in these other market avenues, the institutional shift is undesirable.

Conclusion: Materials, Coordination, and Institutionalization

Apple varieties can carry interests with them as they mobilize institutional rules and social relations. They are biological materials that people organize around. Because of the differences between varieties, there is an observable physical, objective boundary that has been reproduced through cultural practices, and people can create social distinctions that spread those distinctions further apart. I have discussed the significance of those varietal boundaries in the apple industry elsewhere, but I have emphasized in this paper how the meanings of those physical differences become politicized as they get extrapolated into an institutional architecture.

I am suggesting that those political materials can influence the organization of apple production. While typically there has been organization around apples regionally and among growers, club varieties organize across different actors along the supply chain. It is a type of vertical integration, but one that doesn't fully integrate each of the actors. In doing so, it emphasizes competition based on *varieties* rather than orchards (or regions, packinghouses, or prices). Varieties are a cohesive market object that achieves one market price, and are organized around a common quality standard. The vision of a varietal based competition is the economic ethic behind the club apple institution, and that ethic has received criticism. One of those criticisms is that varietal competition is not logical or reasonable given the current institutional arrangement of apple production. Actors in a wholesale market should not be privileged over others, and the world that they

respond to is not one that all growers are willing to accept as a reality. Varietal competition is assuming that there is one market in which demand is finite and apple consumption is inelastic. The varietal competition model also encourages growers to commit and invest in one variety as though other varieties are less important. In some ways, growers are always bound to invest more in some varieties more than others, because their resources are finite and the labor demands of the trees, expansive. On the other hand, if the success of one variety undermines the success of another, growers are placed in an undesirable position where they have to invest and depend more on one variety.

What is the purpose of this varietal competition and institutional mobilization? The main purpose is to revive a wholesale industry, which has been suffering under the pressure of retail conglomeration. From the interviews I conducted, many of the growers were anxious about commodification processes that pushed the price of the apple below the cost of production. They were unhappy about the uncertainty of price, and a system in which "if you did a good job, you would be the one, in the end, that would suffer," as Paul, a large grower and packer described. In other words, control of the variety along the supply chain is seen as a way to flatten out a price curve through more coordination. The coordination occurs by having an agreement about what the apples are going to be like when they enter the market. It exists when the marketing group decides where the apples are going to be sold. The group will decide how many apples are going to be sold in each region, and which packing lines are going to pack and store the apples. Overall, control over the apples, as an object produced in places and moving to markets,

gives growers more control over their brand and more control over price, and this is set against a system that was seen as increasingly individualistic and commodity oriented: where growers would simply be confronted with a market price after they produced their apples, and took all of the risk if the price of the apple dropped. By getting the universities and packhouses to have a stake in the success of the variety, the benefits may get more evenly distributed, and the growers are not the only ones that suffer losses when the variety drops in value. The packinghouses, and the marketing teams associated with them, would also be considered accountable for the economic vitality of the apple.

The club model has advantages for the packinghouses involved. They can maintain a marketing position and secure a profit stream, but it also helps to ensure a way of life is maintained in which they are integral. Wholesaling seems to be an increasingly undesirable practice for growers. They do not make any money, and they are often frustrated with the quantity of apples that get sorted into lower grades or even processing apples. Many of the growers I spoke to said that they used wholesale markets to dispose of apples that they could not sell directly. On the other hand, some growers are committed to a vision of farming that is distinctly wholesale. They are disinterested in farm stalls and uncomfortable with u-pick operations. They also see these experience based industries as being distinct from food production, which is about feeding people and pulling them away from potato chips and candy bars. Many of the growers I spoke to felt that there was something distinctly important about providing food to people in a supermarket setting, and

maintaining a farm that was oriented purely towards the production of the best apples possible.

There are also advantages significant advantages for universities, given current financial constraints, but the impact of the new economic position of universities should not be under-estimated. Many of the universities producing club varieties have traditionally been responsible for generating apples that keep the industry altogether vibrant. The universities are responding to the demands of growers by controlling the apples so they have less volatility on the market, but by enacting this response, they are incorporating that volatitity into their own organization and institutionalizing it. The actual varieties that get produced are a reflection of commercial markets, and the arrangements through which they are sold similarly have a neoliberal flavor that accepts and reproduces privatization. By depending on such a system for their own funding, they are becoming less public. The assumption is that producing a high priced, high quality apple will elevate the industry overall, but by participating in varietal competition, they may also be competing with other growers. The competition that emerges between universities and the publics they traditionally serve may be the clearest way in which universities have become private.

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Conclusion

The three articles included in this dissertation are three slightly different frameworks, used to build a theory of *the biology of markets* based on a case study. Each of the papers discusses the ways that biological materials a role in institutional organization. They highlight aspects of production, and each make arguments about how the apple figures into the organization of the apple economy. The first suggests that observable differences between apples, such as color and size, paired with their propensity for mutation, have propelled a type of treadmill of improvements, which ultimately generates very similar apples. Those differences have also provided a foundation for people to organize around. The second paper looks at the ways that the demands of the materials, namely dwarfing trees, may influence the range of actions that people perform and how they perform them. I suggest that modernizing the orchard landscape in this way encourages more grower creativity and a more customized orchard, which also makes space for more grower collaboration and community. While the rootstocks have the potential to generate more grower agency by expanding ways to innovate, they can be limiting if creativity can only be used to better fit market defined production goals. Both of these conditions could be seen to influence the development of clubs. Lastly, the final paper suggests that clubs, as social closures around materials, are a form of institutional change that particularly benefits actors in a wholesale market. In doing so, they advance an organizing ethic of varietal competition that may conflict with existing orchard

practices. All these together have contributed to an overarching argument that there are some biological aspects to economic markets.

They also have different implications for how materials relate to capitalist economies. The notion of the free market has been debunked within many academic circles. Some have argued against the notion that we can have free choice, or pure preferences, or operate with an aim to maximum utility, because choice is always context dependent. Information is always incomplete. The free market may also be constrained by materials that make some practices easier than others. Agriculture can be the prime example of material constraints because plants behave unpredictably but are so heavily involved in all types of production. There is always a significant time lag between planting and harvesting that makes it difficult to respond to the market or plan the orchard based on market conditions. Weather and climate can quickly lead to crop failure. New insects can emerge on the orchard and suddenly explode in population. It would be difficult to participate freely in the market, even if free participation possible. There are always surpluses and shortfalls, weather toss-ups, and shifts in the demand of varieties. Planning and making the production income as stable as possible is desirable, and perhaps stabilizing the contours of the variety can aid in that process. Taking control over the definition of a variety, and how it should be grown and sold, is taking control over the conditions of production. Stabilizing materials can be stabilizing economic action.

We do not know everything that a material can do, because it is situated in context. This is a basic tenet of actor-network theory. What things *do* is relational

and completely dependent on the *doings* of other things. On the other hand, the things that can be done are not limitless. It would not be possible to add a new element into production and immediately turn all the apples on the tree a glorious shiny red color. We don't know how to reproduce trees in ways that will ensure the apples are red. We are limited, and bumping up against those limitations, and being sorted in reference to them is part of what creates the differences capitalist systems expand. If all the apples could be perfectly controlled and produced to fit the ideal apple—large, red, and the right balance of sweet and tart, or small and green and just enough to satisfy the consumers of small, green apples—there would be no economic benefit to producing apples in one way or another. Perhaps clubs and other institutions would not exist, having no friction between the imagination and desires, and the ability to produce the goods to satisfy. As it stands, that friction is inevitable and produces some gap between what is possible and what is wanted, and the extent of that gap is often unknown and creates the instability that things like clubs attempt to manage. The character of that gap and how it is produced—be it through an inability to produce perfect apples or the inability to convince people the are perfect, or the failure to ensure that every apple is the best apple it could be, or the refusal of trees to naturally produce uniformity—may have an influence on how actors, together, go about their productive work. Perfect information probably would not assuage the problem of market instability.

By the same token, all goods being produced have material limitations, just like apples. There are aspects of those materials that are prized, and they are prized, at least in part, because they are variable. If all diamonds were the same size,

nobody would care what size they were on a wedding ring. The jewelry industry would change, and perhaps the cut and color would become much more important. If steel could be easily fashioned into the same quality of blade, and plastic had only one level of durability, there would be less difference between the $300 food processor, and the one you find for $5 at the thrift store. How these various materials can be used is important, and thinking about the materialist underpinnings of organization could provide another dimension to work in economic sociology and sociology more broadly.

In conclusion throughout each of the papers, I have stressed the ways that the apple is a participant in the economy. I have suggested that there is a biology of markets, and that this is tied to the social life of the variety, and the social life of trees. While the apple industry provided a fairly lucid case for examining the relationship between plants and economic life, I wonder how economic principles and thought might change if we took the nuances of plants and materials more seriously.