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Taylorism Comes to the Fields: Labor Control, Labor Supply, Labor Process, and the Twilight of Fordism in California Agribusiness

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abstract

When the Bracero (*guest worker*) Program ended in 1964, California agribusiness seemed to be facing a labor crisis. Growers had lost access to a large pool of essentially unfree labor, and (consequently) unionization in the fields was on the rise. As a result, researchers in the various agricultural divisions of the University of California embarked on a broad effort to reengineer the farm labor process through the development of labor aids; mechanization of pruning, thinning, and harvesting tasks; redesigning fruits and vegetables; and extensive time-motion studies. This article traces these efforts and uses their history to argue that labor and economic geographers should focus attention on how struggles over the labor process are frequently struggles over the ability to shape and deploy the labor supply and not only matters of how work is organized on the shop floor (or in this case, in the fields). More broadly, the article argues that focus on the fine-grained details of innovation in the labor process is vital for a full understanding of fundamental transformations in the agribusiness landscape. As a consequence, the article explains why a set of innovations, which contemporary analysts figured would lead to agriculture adopting labor relations much more like those in more traditionally Fordist industries, actually paved the way for a set of even more highly casualized, exploitative relations than had existed heretofore.

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> Agriculture is approaching a time when we need to test all possibilities to reduce farm labor costs per ton of product.[1]

In 1922, the California Commission of Immigration and Housing (CCIH), the state regulatory agency most concerned with farm labor, confessed to being impressed by the *Fordism* it found in the agribusiness landscape (CCIH 1922; Mitchell 1996). Rather curiously, given how tightly the two are entwined in both academic and popular imaginations, it would take another forty years before something like Taylorism made a similar mark in the California fields. In the early 1960s the University of California (or UC), working closely with various large growers, commodity associations, farm equipment manufacturers, plant breeders, and so forth, launched a concerted and broad-based effort to rationalize the labor process in California agriculture. In 1964, the growing power of organized labor together with a collapse of public and political support forced an end to the Bracero Program, which, over its 22-year existence, saw more than 4.5 million Mexican men imported into the US as guest workers for agricultural work. The end of this guaranteed supply of essentially unfree labor (cf. Reid-Musson 2017), available to be deployed when and as needed, or sent home when not, forced growers and researchers to focus attention on the labor process. Over the course of a decade, enormous resources were thus devoted to developing labor-replacing and labor-enhancing machinery, engaging in time-motion studies to make harvesting and other tasks optimally efficient, experimenting with breeding to develop cultivars more readily adaptable to something like assembly-line production, and so forth.

Such experimentation was given added impetus by the mounting successes of the newly resurgent agricultural labor unions, the Agricultural Workers

[1] J. H. MacGillivray, R. Sciaroni, and W. Sims, "Labor Use and Variety Studies with Brussels Sprouts," Vegetable Crops Series 122, University of California, Davis, March 1962, 16, University of California Cooperative Extension Archive (hereafter UCCE), Santa Barbara and San Louis Obispo County Collections (hereafter SBSLO), University of California Merced Library. Many of these records are available through the University of California's online archival document portal, Calisphere.org.

Organizing Committee and the National Farm Workers Association, which after their merger into the United Farm Workers Union (UFW) began winning contracts that included among their provisions the establishment of union-run hiring halls and thus significant involvement in creating and deploying the pool of available farm labor.[2] In other words, the end of the Bracero Program together with the growing success of the UFW portended a massive shift in the nature of control over the labor supply in the California fields, from a regime in which growers cultivated a ready supply of unfree, *just-in-case* labor, coordinated by government agencies, and deployed by grower-run farm labor associations in league with innumerable independent farm labor contractors (FLCs), to one in which the UFW threatened to become the dominant farm-labor contracting agency and thus exercise significant control over the size, quality, and availability of the labor force—over the labor supply.[3]

The argument I will make in this article is that the intensive focus on Taylorist interventions into the labor process in the California fields in the 1960s has to be understood as a direct response to growers' loss of control over the labor supply. Attempts to rationalize the labor process must be understood as efforts, on the part of California growers and their allies in the agricultural departments of the University of California, which undertook the lion's share of the research and experimentation along these lines, to regain control over access to and the deployment of labor under significantly changed conditions. By focusing on innovations in the labor process, growers sought to refashion the qualities workers needed to work and thus enhance their abilities to tap into hitherto relatively untapped sources of labor power (primarily unskilled and women workers), and thus, simultaneously and not coincidentally, to undermine the power of the UFW, which made its greatest inroads among relatively skilled farmworkers. Coupled with efforts to heavily recruit often undocumented workers from Mexico, legislative efforts to reestablish guest worker programs they could fully dominate, and the cultivation of a new class of intermediary FLC's beholden to growers and growers associations themselves, efforts at labor process innovation were a significant, though heretofore underappreciated, tool in the growers' post–Bracero Program efforts to regain their slipping control over the formation and deployment of the labor supply.[4]

To the degree they were successful, however, the Taylorist efforts undertaken in California had the ironic effect of ushering out the kind of Fordism CCIH had identified forty years earlier and the creation of an agrarian political-economic regime of accumulation and labor that economic geographers of the 1980s—exactly the time when these efforts were coming to fruition—might have described as quintessentially post-Fordist: marked

[2] The unions that formed the UFW went through a number of name changes between the early-1960s and the mid-1970s. To simplify the following discussion, the unions will be referred to by their eventual moniker, the UFW.

[3] That this was a primary concern for growers at the end of the Bracero Program is confirmed in innumerable public pronouncements but also in the records of negotiations over UFW contracts. See, for example, UFW general counsel Jerry Cohen's notes on negotiations between the UFW and the Giumarra grape growing corporation, July 25, 1975: "1st big issue hiring hall—worried about wk [work] force." Jerry Cohen (AC 1963) Papers, Box 17, folder 1, Amherst College Library Archives.

[4] That control over the supply and deployment of labor has historically been something of the growers' holy grail—and a vital component of the development and structure of the California agribusiness landscape—is confirmed in innumerable contemporary and historic analyses and is the focus on the next section. Most prominently, see Fisher (1953); Daniel (1981); Fuller (1991).

by much more fine-scale engineering of the production process, even including a growing emphasis on small-batch specialty production (within the context of mass-marketing and market segmentation [Guthman 2004]); intricate divisions of labor (FitzSimmons 1986); increased flexibility in labor deployment through an expanded use of FLCs (Krissman 1995; P. Martin 2001); a massive increase in the number of seasonal, marginally employed farmworkers (Bugarin and Lopez 1998); the defeat of the unions; and, at times, delayed and even forestalled efforts at mechanization. As I will argue, under these conditions, growers could once more count on there being (more than) enough workers to harvest their crops, possessed of the requisite skills, deployable when and as needed by FLCs, and without the UFW or other unions exercising control over this labor supply's formation or deployment. In part through their focus on the labor process and the nature of their own demand for labor, growers succeeded in regaining a good deal of control over the supply labor they needed to cheaply tend and harvest their crops.

This is not at all what analysts of the time expected. Writers in the early- and mid-1960s expected the future would be defined by galloping mechanization but also by a significant *de*-casualization of labor, a declining number of farmworkers, and the reskilling and unionization of those that remained (e.g., Rasmussen 1968). This article sets out to examine why concerted efforts to mechanize production and rationalize labor processes had something like the opposite effect than predicted. I argue, in short, that to answer this question requires examining the ways in which struggles over the *labor process* relate dialectically to struggles over *labor control*. These struggles over labor control may be focused in the first instance at the place of production itself, but the long-range goal of growers, especially when coupled with fights over the borders, use of FLCs, and against the union's efforts (among other things) to create hiring halls, was to regain power over how *labor supplies* were constructed and deployed. That is to say, understanding the push toward Taylorist rationalization of the labor process requires understanding how the specificities of this rationalization at the point of production redounded into the sphere of labor circulation, where struggles over control of the labor supply could be intense, even as struggles in that sphere provided a significant impetus for innovations in the labor process.

This study is primarily based on an evaluation of documents produced by University of California agricultural researchers and agents and researchers in the University's Cooperative Extension Service, as well as reports of experiments and innovations in the University of California Davis's house journal, *California Agriculture*, which had a wide circulation among researchers, agriculturalists, and policy makers in the state and published reasonably in-depth articles assessing a range of matters related to agriculture in the state, including reports of when experiments in mechanization and rationalization failed to live up to expectations or proved unfeasible. I have reviewed every document available in the University of California Merced's Cooperative Extension online archive,[5] selecting all those that impinged in anyway on matters of mechanization and/or the labor process. Similarly, I have examined every article published in *California Agriculture* between 1958 and 1990, using the same criteria for selection. From these sources, I have sought to select for discussion examples of experiments and innovations that illustrate both the breadth and the depth of the labor rationalization process. Through

[5] https://calisphere.org/institution/238/collections/.

them, it becomes possible to see how the question of labor process at the point of production in California, which reshaped the nature of demand for labor power, was always also a question of labor control within the sphere of circulation and thus reshaped the nature of control over the labor supply.

Labor Supply, Labor Control, Labor Process

Writing at the height of the bracero era, labor economist Lloyd Fisher (1953) argued, correctly, that though California growers' primary mantra had always been cheap labor what they wanted even more were predictable and dependable labor supplies. Given California's highly intensive form of geographically differentiated specialty-crop production—the organization of production into specialized single-crop districts (Stoll 1998; Henderson 1999)—that required massive numbers of workers for short periods at harvest time and often very few workers at other times, California growers' traditional means of assuring predictability (if not dependability) was to cultivate a labor *over*supply, waiting and ready as the harvests ripened (Daniel 1981; Fuller 1991; Mitchell 1996). The Bracero Program deepened the dependability of labor supplies. Expected numbers of required hands were determined well in advanced of the harvest; and routinized, government-sponsored recruiting in Mexico, together with an elaborate infrastructure that deployed braceros to labor supply camps around the state, assured that an oversupply of labor was in place *just in case* it was needed (and if it was not, it could be rapidly deployed to another part of the state or repatriated to Mexico) (Rasmussen 1951; Galarza 1964; Mitchell 2012). In the words of economic historian Wayne Grove (1996, 302), the Bracero Program created a kind of "government-administered labor market insurance" for growers. It created a level of control over the labor supply that growers had never heretofore had, a "dream of heaven," in the words of California agribusiness critic Carey McWilliams (quoted in Calavita 1991, 21).

Under such conditions, intense focus on innovations in the labor process was often unnecessary. Indeed, growers tended to innovate on labor process only when forced to by threatened labor shortages or rising militancy among workers. Conversely, as such threats receded, so did the imperative toward labor process rationalization. For example, at the outset of World War II, when war-related industries were beginning to sop up the large Depression-era agricultural labor surplus in the state, and especially in the sugar beet industry, growers called for a massive labor importation program from Mexico. Researchers with the US Department of Agriculture's Bureau of Agricultural Economics countered that with a few changes in the labor process, most notably replacing the inefficient and health-damaging short-handled hoe with a long hoe, coupled with growing cultivars that could be blocked and hoed with fewer moves, the need for imported labor in the Salinas Valley (the heart of the beet district) during the blocking and thinning season would be eliminated (Mitchell 2013). But growers won the ability to import guest workers anyway, and the advice went unheeded. Though advances had been made in precision planting and mechanical thinning and blocking, adoption of such technology was delayed until after the war (though mechanization of beet harvesting, which was even more labor intensive, and in which peak demand coincided with peak demand in numerous other crops around the state, was rapidly accomplished in the first years of the conflict) (Runsten and LeVeen 1981).

By contrast, for various reasons, but largely because a significant oversupply of labor remained, cotton growers did not turn to bracero labor during World War II. Nor did they make much effort to adopt mechanical harvesters when they were developed during the war. After the war, however, cotton growers were hit by a wave of strikes in 1949–50. Though growers and the National Farm Labor Union agreed to an "informal contract recognizing the union as hiring and bargaining agent for cotton pickers" (Valdés 1994, 108) growers rapidly purchased recently developed cotton-harvesting machines and began importing braceros to replace so-called domestic workers for those tasks that machines could not accomplish. Mechanization, as well as a shift in the nature of the labor supply, was induced by worker militancy (Valdés 1994). The point with these examples is simply that innovations in and struggles over labor processes (how to block beets, for example) are intimately connected to transformations in and struggles over labor control (e.g., undermining cotton pickers' unionizing efforts) and thus in labor supply (refusal to innovate in beets necessitated and was made possible by access to bracero workers; mechanization in cotton created a massive new reserve army of labor).

The relationship between labor control and labor process is of long-standing interest to economic geographers. In pathbreaking work, Andrew Jonas (1996), for example, developed the concept of a *local labor control regime* to explore this nexus. As he argued,

> Labour control is more than simply a technically- or cost-driven imperative in which capital finds new ways to improve efficiency and labour productivity. It is an irretrievably historical, cultural, and spatial process involving the uneven development of practices which smooth the transition of labour from the labour market to the point of production, reproduce a productive work force, co-ordinate conditions of pay and consumption, and thereby facilitate accumulation strategies. (Jonas 1996, 328)

Jonas's particular interest was in the ways in which indirect forms of labor control—which he referred to as reciprocities between capital and labor that recognized the limited agency of each to fully determine the conditions of work—related to "*direct* or despotic methods," which "involve management or owner surveillance and monitoring of workers and their use of technology at the immediate point of production" (Jonas 1996, 327) and thus created a localized labor control regime that both workers and firms had to negotiate (and might seek to transform).

This is an important issue, but it also assumes, at least tacitly, that the labor market is comprised of a relatively stable, emplaced, and legible workforce, which is not accurate for California's farm labor markets. Even though the majority of the workers do not follow the crops in the sense of constantly migrating with no fixed abode—many if not most have home bases—work is peripatetic, precarious, rarely continuous on a single farm, and often organized through growers' labor associations and FLCs rather than directly hired. During the Bracero Program as much as 40 percent of the total labor force was comprised of guest workers, and in some crops (like processing tomatoes) as much as 98 percent of the harvest workforce could be deportable, unfree guest workers (Mitchell 2012). The question of the relationship between labor control and labor process took on a rather different complexion than the circumstances Jonas described. Even so, the idea of a labor control regime is helpful. During the bracero era, this regime was defined by the deployment of unfree labor: the administration of

the program and its usefulness in creating localized surplus labor pools—labor market insurance, just-in-case labor—*constituted* the regime of labor control.[6] As this regime broke down with the elimination of the program in 1964, a new regime had to be constructed, and, I will show below, this regime was constructed, at least in large part, from *within* (or rather through innovations upon) the labor process. Growers expected that by simplifying and disaggregating labor tasks, transformations in the labor process would help reestablish labor oversupplies and thus recreate a kind of *labor market insurance* —and hence growers' control over their own supplies of labor—if operating on rather different principles than such insurance had during the bracero era.

Growers' interest in the labor process, in other words, was driven in part by their interest in controlling labor at larger scales, beyond the point of production itself. The way labor process as enacted at the point of production intersects with larger-scale processes has, like the relation between process and control, also been of long-standing concern to economic geographers. Within the last decade, geographers concerned explicitly with labor have deepened geography's engagement with labor process theory (Rainnie, McGrath-Champ, and Herod 2010; Ross 2011; Ellem 2016; Hasting and Cumbers 2019; Annant and Coe 2021). For Rainnie, McGrath-Champ, and Herod (2010) and a number of others, the point of synthesizing labor geography with labor process theory was precisely to show how the organization of work is conditioned both by spatial struggles on the shop floor *and* by large-scale local, regional, national, and global struggles over the location, mobility, and deployment of labor power. As Hastings and MacKinnon (2017, 105) confirmed, "the micro scale of the workplace is not, of course, autonomous of broader social forces." But they also argued for a need to better understand "the reciprocities negotiated between labour and capital at the site of production itself," (Hastings and MacKinnon 2017, 105) or what Rainnie, McGrath-Champ, and Herod (2010, 299) termed "the micro-geographies of the workplace." A close attention to these microgeographies, and the struggles over them can reveal the "ways in which creativity (human 'doing') manages to co-exist alongside forced processes of abstraction inside the labour process" and thus how workers "*re-work* seemingly de-skilled positions" (Hastings and Cumbers 2019, 1457). The overall aim, then, is to show how workers constantly reshape the conditions of their exploitation, not infrequently in ways that enhance their agency, and indeed their autonomy "to maintain personal visions of what work should entail and feel like" (Hastings and Cumbers 2019, 1457). Research by Hastings and MacKinnon (2017) and Hastings and Cumbers (2019), in other words, aimed to show how workers continually seek to take hold of the labor process and in so doing transform how it works. Studies seeking to understand the broader-scale conditioning of the specificities of the labor process in particular places, like that of Rainnie, McGrath-Champ, and Herod (2010), have a similar aim: they primarily focus, empirically and theoretically, on different aspects of the struggles that determine the nature of the labor process, and thus more generally on how cultures of work evolve (Ellem 2016).

These, too, are important matters, but they also tend to turn attention in a particular direction: to the degree that broader social forces are of concern (as in Rainnie, McGrath-Champ, and Herod [2010]), it is to understand how these social forces and structures

[6] See Mitchell (2012) for how growers deployed braceros in ways that drove other workers out of the fields.

shape the labor process. Less common are studies of how highly specific, often highly technical transformations in the labor process work back and shape those broader forces and structures, for example, the structure of the labor control regime. Yet the evidence from California in the 1960s indicates just how important innovations in labor processes are for reshaping labor demand and thus the deployment of the labor supply as a whole. That is to say, it is important to understand the shifts in the labor process not only as a function of struggles at broader scales (as well as on the shop floor), but also, and in the case of California, especially, as ways to both *negotiate* and *induce* shifts at these broader scales, shifts, that is, in the labor control regime. Efforts to control labor at the point of production (by enhancing it or displacing it, by mechanizing some tasks and making others irrelevant, etc.) must be understood in dialectical relation to efforts to shape and access the labor supply itself.

Of course, such efforts to shape the labor supply at the end of the Bracero Program were not only a question of innovation in the labor process. Agribusiness was pervaded by a general sense of crisis when the program ended, and efforts to resolve the crisis were many and diverse, including attempts to revive the program; have it continue under different legislative auspices; recruit teenagers, university students, and housewives; indenture domestic (non-bracero "free") workers; ship production to Mexico; heavily recruit undocumented workers; and even, in some isolated cases, raise wages and improve labor camp conditions (Mitchell 2012). Whatever the effect of these efforts (and in some locales and crops, they could be significant), none was as thoroughgoing and systematic as the turn to mechanization and labor process rationalization, an effort forced, to a significant extent, by the dual pressure of the permanent loss of the bracero's unfree labor power and the associated rise of unionization in the fields. Understanding how experimentation and innovation in the labor process at the point of production shaped the nature of and access to the labor supply requires a close examination of at least a few of the wide range of Taylorist efforts undertaken by University of California researchers and growers as the Bracero Program came to an end.

Taylorism in the Fields

As already indicated, there had been earlier efforts to rationalize the agricultural labor process (or parts of it). But they were largely sporadic and often piecemeal (as in beets). Perhaps the most concerted effort occurred in the lemon orchards around Ventura, where shrinking labor pools and deteriorating conditions led to a series of strikes between 1941 and 1943, leading the major orchardists to request that the University of California develop an incentive pay system. The result—"a straightforward application of Frederick W. Taylor's scientific management principles," according to two later analysts (Runsten and LeVeen 1981, 80)—was derived by

> study[ing] the rate of picking and its relationship to the height of the trees, yield of the orchards and other variables, and then … devis[ing] a piece-rate schedule which varied with the daily variation in such factors. Overall, however, the schedule was designed to yield, in any one year, a certain average hourly wage to an "efficient" worker. (Runsten and LeVeen 1981, 80–81)

In the case of lemons, rationalization was not delayed by the arrival of bracero workers (as it was in beets); instead, by adjusting pay rates to the vagaries of the naturally varying

productivity of the means of production, it became the means both to control the labor of, and demand greater productivity from, the bracero workers who by the mid-1950s dominated the labor supply in that area.

The lemon rationalization effort paid significant dividends. In the first year, the rate of pick was increased by 40 percent over the old system, while the number of pickers declined by 29 percent, allowing growers greater flexibility in the deployment of the existing labor supply. Between 1947 and 1964, the average worker's rate of pick increased another 24 percent. Given the dependency of lemon growers on bracero labor in the postwar era, the end of the program, together with memories of the success achieved in the 1941 rationalization, led to a reintensification of rationalization efforts, efforts that had an overall effect of decreasing labor demand by 50 percent between 1966 and 1972. Per-box production costs increased by less than 20 percent over the same period, a period when the consumer price index increased by 33 percent (Mamer and Rosendal 1975; Runsten and LeVeen 1981). Now, though, rationalization in lemons was accompanied by similar attempts in just about every other crop in the state.

In July 1966, for example, the University of California Davis's *California Agriculture* reported on College of Agriculture research on labor carriers (carts on which workers sat or lay in lieu of walking the rows) for farmworkers engaged in thinning and weeding in field crops like cauliflower and lettuce. The hope was that such aids would "make the work more attractive" given that, with the end of the Bracero Program, "the supply of labor to do the work is increasingly uncertain" (Zahara and Garrett 1966, 8). Davis's College of Agriculture was (and still is) California's premier agricultural research center, and throughout the postwar period it devoted significant resources—both public money and funds donated by agribusiness, petrochemical, food processing, and other industries—to the development of plants, chemicals, and machines aimed at intensifying agricultural production in the state, resources that significantly increased when it became clear the Bracero Program would end (Valdés 1994). Plant breeding, experimentation with pesticides, herbicides, and fumigants, innovations in cultivation, and the development of new agricultural machinery were all foci of research efforts by College agronomists, chemists, and engineers. Economists in the College examined the shifting political economy and sought to discern how California growers could improve their competitive position within it, where new markets could profitably be opened, and the forces leading toward, or away from, greater consolidation in the industry. Other scientists focused on questions of preservation and shipping of harvested produce; innovations in canning, freezing, packing, and processing; and the effects on both the aesthetics and the nutrient value of fresh produce stored for long periods of time. The College of Agriculture also coordinated the work of the wide network of county-based farm extension agents charged with spreading new knowledge to growers while feeding grower intelligence back to researchers at Davis, other agricultural research departments in the University of California and California State University system, and the several experimental research stations the University of California operated around the state (see Henke 2008).

Traditionally, however, UC Davis (and other) researchers did not devote much time and energy to the labor process itself. But with the demise of the Bracero Program, this changed, and the labor carriers *California Agriculture* reported on in 1966 were a fairly

typical effort on this front. In this case, a beam was placed on wheels high enough to clear blocked rows of cauliflower seedlings and fitted with a padded seat with adjustable foot supports on one side and, on the other, a platform a worker could lie on face down. The contraption, towed by a tractor, allowed for a whole series of controlled experiments to assess the efficiency and comfort of seated and prone workers compared to workers thinning in the traditional manner—walking through the field with a short-handled hoe. In later experiments, a six-person, self-propelled carrier with both seated and prone positions was devised. Researchers found that when the two-person carrier was used without any other adjustments to cultivation, it had a negligible effect on how long it took to thin an acre. When, however, it "was used in combination with blocking, weed control, and precision planting, the results become more significant": 61 percent and 38 percent time savings were obtained when rows were blocked to two and four inches, respectively; eliminating the weeds in advance of thinning led to a 26 percent time savings; and precision planting that left one- to two-inch spaces between plant clusters, combined with the labor carrier, saved 32 percent (Zahara and Garrett 1966, 8). In terms of comfort, "workers using the crew carrier differed in their preference for the seated and prone supports, but they generally agreed that either position alone induced fatigue. Thus, the practice of alternating positions at the end of each row was adopted" (Zahara and Garrett 1966, 8). The authors of the report cautioned that the results needed to be interpreted carefully, since there were "problems matching workers of comparable skill and in supervising the crew." Even so, when combined with significant changes in cultivation practice—increased use of herbicides, preblocking rows, precision planting—the contraption showed promise as an aid "in attracting and keeping labor for thinning and weeding," while possibly being cheap enough to allow farmers to translate efficiency gains into lower costs (Zahara and Garrett 1966, 9).[7]

The labor carrier was typical because, as with so many other experiments in making field labor efficient, it was induced by a feared labor shortage—a loss of control over the labor supply—as a consequence of the end of the Bracero Program but just as much because, in order for it to be adopted, it would entail a significant restructuring of the total production process, from the application of more chemicals to the greater use of machines.[8] It was atypical, however, in that it did not require, at this early stage anyway, new cultivars, or innovations in packing, canning, and preserving, as did other innovations in the agribusiness labor process.

This is not to say that research on these fronts was not under way; it most certainly was. As the University of California Cooperative Extension wrote in its 1967 "State Report of Work,"

[7] Even as UC Davis researchers were experimenting with labor carriers, other University of California researchers were conducting research on replacing labor altogether in lettuce thinning. University of California Agricultural Extension Service, "State Report of Work, 1967: Vegetable Crops," 15, UCCE Ventura County Collection (hereafter VEN).

[8] For other examples, see Christensen, Kasimatis, and Burlingame (1969); Studer et al. (1966); M. Snyder and A. D. Reed, "Artichokes, Santa Barbara County, 1965," UCCE Humboldt County Collection. Guthman (2019) offers the best account we have so far of how shifts in one aspect of production—the resort to chemical fumigants in her case—ramify through the totality of the agricultural production system: from how, where, and which seedlings are grown, to property regimes, to university practices, to marketing strategies, to the labor process itself.

> a search for broccoli and cauliflower varieties better suited to mechanical harvesting has been initiated. With a steady 5 percent increase each year in processing crop acreages, it has become paramount that varieties, in addition to high yield and quality, also be adaptable to mechanization. The economics of producing crops dictates a high level of mechanization.[9]

Similar efforts to develop cultivars suitable for mechanical harvesting were under way in pickling cucumbers, fresh (as opposed to canning) tomatoes, bush snap beans, and more, while efforts to develop labor aids picked up steam in cantaloupes, raisin grapes, wine grapes, and all manner of tree fruits.[10]

In parallel with experiments with different sorts of labor aids,[11] researchers undertook innumerable time-motion studies and experiments. In one study, several orange pickers were outfitted with respirators that allowed for an estimation of energy expended while undertaking various tasks: picking the fruit reachable from the ground; picking fruit from a ladder; carrying, setting up, and scaling the ladder; and bag-carrying. The goal was to understand what sort of aids would most assist harvesters in their tasks by reducing the physiological costs of work and thereby improving efficiency (Schertz 1967). At the same time, researchers, averring that political and economic pressures—that is, the end of the Bracero Program and the mounting success of the unions—had left mechanization as the only alternative, built scale models of orange trees to measure necessary removal force when pulling the fruit from different angles, experimented with various chemicals to ease abscission (separation from the stem), tested the use of explosives to separate the fruit from the tree, and researched the feasibility of light reflectance for determining ripeness (Schertz and Brown 1965).

In another experiment aimed at judging the most efficient use of workers' bodily energy, a whole series of different labor aids were tested in raisin grape pick-up and boxing operations. Comparisons were made between the traditional practice of walking between rows of raisins that had been dried on the ground and lifting them into trailers towed by a tractor and a range of other collection techniques: hand collecting but using different receptacles, hand collecting while sitting on a towed platform, and machine picking with various containers. Each technique required a different suite of equipment and a differently sized crew. Researchers found that all the tested techniques "resulted in labor saving of at least 1 man-hour per ton" and that machine collecting lowered cash outlays (Christensen, Kasimatis, and Burlingame 1969, 7).

Brussels sprouts were a particular focus of attention for researchers investigating labor aids and workers' time-motion expenditures. Beginning in 1961, researchers established a set of test fields on a farm in San Mateo County for repeated annual experiments. Two sets of eight different varietals were planted (six British, one local, and one from

[9] "State Report of Work, 1967: Vegetables," 33.

[10] UC Agricultural Extension Service, "State Report of Work, 1967: Viticulture," 7, 11, UCCE VEN.

[11] In addition to labor carriers, UC Davis and University of California Cooperative Extension researchers tested the use of hydraulic platforms to replace ladders in orchards; bins on trolleys to replace carried sacks for collecting melons, fruit, and grape harvests; and specialized pumps and nozzles that applied date pollen to replace hand application in date plantations. The research on mechanization of date palm pollination and harvesting "was begun in fall, 1961 … with the impending termination of the bracero program[;] it was imperative that the large peak labor requirements be reduced … Over 700 men were required during pollination, and nearly 900 men were required at the peak of the harvest," UC and US Department of Agriculture scientists recalled a dozen years later after "commercial mechanization of date pollination became a reality in 1973" (Perkins and Burkner 1974, 6).

Holland bred specifically for freezing). The first set would be hand harvested in the standard way (multiple passes separated by two weeks); the second would be hand harvested with a longer pause (four weeks).[12] Harvesting consisted of trimming away large leaves, plucking adequately sized individual sprouts from their stocks, placing the trimmed sprouts in shoulder bags, and depositing the bags at the end of rows when they were filled.[13] A crew of bracero workers was hired to harvest the fields under controlled conditions. The length of time it took the crew to harvest each varietal under the two different methods was recorded, along with the size of the harvested sprouts and the overall yield. The primary result of these studies in 1961 and 1962 was that with an increase in the lapse-time between passes, overall yield increased on average 20 percent for all varieties while pickers' output (pounds per hour) increased by 35 percent. Researchers suggested that further savings could be derived by shortening the length of rows to minimize walking time, placing bins at the end of rows that bags could be dumped into, introducing incentive pay systems, and creating a competition where the fastest picker each day would get a gold star next to his name on a board in the labor camp dining room. On the basis of these experiments, extension researchers additionally concluded that significant resources should be devoted to developing high-yielding varieties with more easily detachable sprouts.[14]

In 1964, these studies were complemented by ones assessing the viability of the British single-pass harvest system. Single-pass harvesting was more amenable to partial or complete mechanization. Several operations were tested, including one where plants were mechanically topped three weeks before harvest; two weeks later workers jammed an eight-inch metal ring down the plant to remove leaves; and a week later the sprouts were plucked as before. In another, the first two steps were followed by cutting the stock and then stripping it with various ring-shaped devices in a packing shed. For this process, various means of stabilizing the stock while stripping it were also tested. Brussels sprouts variety was found to make a big difference, with some amenable to pick rates of fifty to fifty-five pounds per hour and one, the Jade Cross, allowing an output of no more than forty pounds per hour. In a final experiment, stripping the sprouts with two beveled ring knives (a smaller one for the upper part of the stem and a larger one for the lower) was combined with minimal hand picking of the topmost sprouts (to create a guide for the ring knives). This process yielded 130 pounds per hour when leaf removal was included in the operation: when leaves were preremoved, pick rates climbed to more than 320 pounds per hour.

Since the plants and stocks were destroyed in the process, these methods only allowed a single pass. Yet extension researchers did not make comparisons of overall yield with the multiple-pass techniques investigated in earlier years. Rather, the goal of these studies was to eliminate certain tasks; to eliminate the need for worker

[12] In a normal harvest, there would be six to ten passes. In the 1962 experiment, however, heavy rains in the second week of October destroyed the experimental crop, so only three passes were made in the regular harvest and two in the long-pause harvest.

[13] The first operation, trimming the leaves, could be done in advance of the harvest pass or as part of it, and researchers did not find any difference in overall labor-time expenditure between the two methods.

[14] MacGillivray et al., "Labor Use and Variety Studies;" R.H. Sciaroni, J. H. MacGillivray, and R. H. Thompson, "Effect of Variety and Harvest Frequencies on Brussels Sprouts Production in 1963," UCCE SBSLO.

discernment (as to, for example, which sprouts to pick and which to leave for a later harvest) and other markers of skill; to simplify the labor process; to improve tools such that the labor process could be both de-skilled and made more efficient; to develop tools that themselves might later prove to be automatable; and finally to determine what plant characteristics (maturation timing, shape of stock, location of sprouts on the stock, etc.) were most amenable to single harvesting.[15]

In general, efforts like those in the San Mateo brussels spouts fields were understood by University of California scientists and many in agribusiness to be "short-range solutions" on the way to the near-total mechanization that the end of the Bracero Program necessitated (Schertz and Brown 1965, 2). And indeed, an impressively wide range of mechanization experiments were initiated in the 1960s. Nut trees were an early success. Efficient tree-shaking machines, proper ground preparation techniques (to make for easy vacuuming up of the fallen nuts), and grafting and pruning for uniform ripening all proved easy nuts to crack (as it were), and California acreage planted to nut trees expanded accordingly (especially in almonds). Soft fruits proved much more difficult. Experiments in freestone peach orchards to mechanize pruning, to replace hand thinning with the use of chemicals, and with tree shaking all failed, though in clingstone peaches, there were some limited successes (though canners were reluctant to accept mechanically harvested fruit), even as researchers underlined the need in both harvests for rapid innovation given "a lack of suitable labor" as the Bracero Program came to an end.[16] A decade later, however, researchers announced that mechanization of Bartlett pears was now economically feasible. The biggest challenge to mechanization (through tree shaking) had been that fruit was damaged as it fell through the trees. A range of options to minimize this threat were thus tested: padding the branches, surrounding the tree with a tent and filling it with ping-pong balls to slow the fall, and using pneumatic tubes to direct the fruit out of the tree as it began its descent. Padding the branches proved cumbersome and the ping-pong ball method was too effective: the balls dampened the force of the shaking so much that not enough fruit detached. The pneumatic tube method worked well. It required, however, that traditional orchards be replaced by "hedged or semi-hedged tree row[s]" (Mehlschau, Fridley, and Claypool 1974, 8; see also Mehlschau et al. 1977); by the early 1980s, hedged pear (and other soft fruit) ranches had become common sites in key fruit-growing regions like eastern Contra Costa County.

The gold standard for the rapid adoption of mechanical harvesting was, however, processing tomatoes, and the obvious success of the effort—together with the range of new contradictions it gave rise to—has attracted the attention of a large number of scholars (Rasmussen 1968; Friedland and Barton 1975, 1976; Runsten and LeVeen 1981; Valdés 1994; C. Martín 2001; de la Peña 2013). Delicate by nature, the first step entailed reinventing the fruit. Working with pear-shaped tomatoes (which experiments showed bruised less than round ones), Jack C. Hanna at UC Davis spent the

[15] J. H. MacGillivray, C. B. Atlee, R. H. Sciaroni, and M. D. Davis, "Further Studies on Harvest Methods for Brussels Sprouts," Vegetable Crop Series 133, University of California, Davis, March 1964, UCCE SBSLO.

[16] "Freestone Peach Production, Fresno County" (1964), N. W. Ross, "Farm Management Short Course for Commercial Bankers: Clingstone Peaches, May 13, 1964," both in UCCE Merced County Collection (hereafter MER).

1950s breeding tomatoes for tougher skins, less juice and pulp, uniform blossom-setting and thus ripening, uniform plant height, and more easily detachable stems (or greater susceptibility to chemical abscission).[17] Meanwhile, Hanna's engineering colleague, Coby Lorenzen worked out the mechanics of cutting the plants, determining the optimal cutting heights (above or below the ground), lifting the plants onto shakers, separating the fruit from dirt clods, transporting it to the conveyor belts for sorting, and the further transportation of the sorted fruit into bins hauled by accompanying trucks. As these processes were improved and perfected, other colleagues worked out optimal conveyor heights for efficient sorting, best placement of sorting personnel and supervisors, and desired degrees of sorting accuracy. Still other researchers determined optimal ground preparation techniques (including precision leveling of the fields); optimal field shape and size; best precision-planting configurations; best thinning practices; optimal fumigation, pesticide, and irrigation schedules; and, importantly, the proper training and especially supervision of sorters so that not a motion, and not a tomato, was wasted—and all of these for a growing range of machine-ready varietals, each with slightly different setting, ripening, and harvesting characteristics; different irrigation and pesticide needs; and different demands on the sorters.[18]

As agricultural historian Wayne D. Rasmussen (1968, 532) argued in a contemporaneous analysis, the successful development of the mechanical tomato harvester required a "systems approach." Its widescale adoption (from less than 1 percent of canning tomatoes machine harvested in 1961 to 99.9 percent harvested by 1970) required a complete remaking of both the means of production (the plants themselves, farm machinery, farm size and field shape, water and chemical inputs) and the associated labor relations and processes. It also required a significant remaking of both the means of production and labor relations *downstream* at the canneries (Friedland and Barton 1975). The effect of the transformation in each of these spheres was extraordinary. California's share of US processing tomato acreage increased from less than half at the end of the 1950s to more than two-thirds by the early 1970s (with a statewide acreage increase of 23 percent); harvest tonnage increased by 51 percent; the number of growers dropped from more than four thousand to just over six hundred. Production shifted southward to where it was possible to develop larger farms (especially as the massive State Water [irrigation canal] Project came online in 1970) (Friedland and Barton 1975). Harvesting machines were expensive, and their economies of scale both encouraged larger farms and discouraged crop rotation. Before the harvest was mechanized, canning tomatoes were often something like an optional crop for many growers, planted when market conditions and rotating schedules aligned in such a way that they could easily be profitable. Acreage planted to tomatoes ebbed and flowed annually. After mechanization, this no longer made sense. Mechanization entrenched monocropping (and thus increased problems with pathogens and pests, deepening reliance on chemical interventions) (Friedland and Barton 1976; de la Peña 2013).

[17] The hormone gibberellin, widely used in agriculture, was found to strongly promote abscission. Simultaneously, efforts were under way to develop "jointless" tomatoes—ones that separated from the plant without leaving any stem that could damage other fruit when the tomatoes collided.

[18] Sims to Process Tomato Farm Advisors, February 11, 1977; "Mechanized Growing and Harvesting of Processing Tomatoes," UC Agricultural Extension Service publications AXT-232 (1968), both in UCCE MER.

Meanwhile, the size and composition of the harvest labor force shifted drastically. Before the end of the Bracero Program, more than 50,000 workers were required at the peak of the processing tomato harvest, of which more than 95 percent were Mexican male braceros. In 1972, only 18,000 workers were required, perhaps 80 percent of whom were Mexican and Mexican–American women (Friedland and Barton 1976). By the end of the 1970s, when optical sorters had been perfected and adopted (largely in response to UFW efforts to organize the sorters), the number dropped even further to 8,000, while acreage continued to climb (Martin and Olmstead 1985). Women tomato sorters were recruited primarily by word-of-mouth in the early postmechanization years (growers preferred "housewives" because, growers assumed, their wages were supplementary, though they could also be "too emotional," "take things personally," "tend to excessive talking," and were "absent more often" than men, even as they were "more loyal," "less ambitious," "follow instructions better," and have "more agile" fingers).[19] Women were, presumably, better able to tolerate the machine-controlled pace of work, restricted scope for physical movement (sorting stations were packed tightly enough to only allow for the movement of arms), and monotony of endlessly repeating a single task than were men (Friedland and Barton 1975). By the early- to mid-1980s, recruitment had been almost entirely outsourced to FLCs, despite predictions from analysts that the influence of FLCs would "continue to decline" in the foreseeable future (Friedland and Barton 1975, 44).

This is what Taylorism in the fields looked like. Enormous resources, extraordinary amounts of research time and energy, and great ingenuity—all spurred by a fear of labor shortages and the threat of union organizing and control over the deployment of labor—sought to dismantle every aspect of the cultivation and harvesting process, from the nature of the plant and the shape of the fruit, to measuring the energy expended in every move a worker made and redesigning tools in order to redesign those movements, to inventing chemicals that would replace many of the labor tasks altogether, only to put them back in new, more rational, scientific, and simplified *components* of what had always been a more organic or perhaps holistic production process. Such simplification was enormously complex—requiring a systems approach—but it meant that production processes could be disassembled into component parts, with some outsourced to producer service providers, including FLCs (FitzSimmons 1986), some eliminated or replaced by chemical or mechanical substitutes, and some remade from tasks requiring discernment and skill to tasks of simple repetition and monotony, which in turn de-skilled labor and made it easily replaceable. Such disintegration of the production process meant that the dialectic between production time and labor time could be reconfigured, its inherent contradictions minimized.

Discussion: Labor Process, Labor Simplification, Labor Supply, and the Twilight of Fordism in the Fields

The contradictory relationship between production time and labor time in California agriculture has always been the central force shaping its labor markets. The highly

[19] J. MacGillivray, "Sorting Tomatoes on Mechanical Harvesters," Vegetable Crop Series 135, UC Davis, January 1965, 4–5, UCCE SBSLO.

peripatetic nature of labor, growers' constant efforts to create labor surpluses as harvests come due and then to dissipate them after the crops are gathered, the intricate racial divisions of labor that have always marked the fields, the concerted efforts to drive border policies in such a way that ensure adequate supplies of labor will always be at hand in an appropriately disempowered way (Mitchell 1996, 2012; Henderson 1999; Walker 2004): all these are driven by the fact that labor time in agriculture is highly discontinuous in relation to overall production time. In California's brand of specialty crop production, therefore, the question of labor supply control has always been (and remains) paramount (Fisher 1953; Fuller 1991). During World War II and in the first two decades after the war's end, control was enhanced through the growers' ability to manipulate the Bracero Program to their own favor (Mitchell 2012) and any innovations in the labor process tended to be a function of the degree to which this supply of unfree labor encouraged or discouraged innovation. For example, the partial mechanization of the head lettuce harvest (especially the development of machine-based field packing) in the 1950s required *more* field workers than when lettuce was packed in the sheds, and the ability to requisition and deploy braceros was clearly a decisive factor in the broad adoption of the technology in the 1950s. Not incidentally it also allowed growers to replace unionized women packing shed workers, with cheaper, nonunionized male bracero workers who had no freedom to move to another job (Runsten and LeVeen 1981; Petrick 2006; Mitchell 2012). Control over the labor supply was paramount, just as it was in the range of 1960s labor process innovations described above (and the dozens and dozens of other, similar experiments and innovations not described in this article but discoverable in both the archives and the issues of *California Agriculture* upon which this article is based).

Crucially, not all labor process innovations were concerned with substituting machinery for people—with labor saving or with labor displacing. As with the various labor carriers UC scientists experimented with, they were nearly as often concerned with enhancing the productivity of labor by creating various kinds of prosthetic devices (carriers, pneumatic platforms, redesigned sacks for carrying produce, etc.) that made work not just easier, but often *simpler*, in turn making workers easier to regiment, direct, and substitute with other workers, undermining workers' abilities to protect any monopolizable skills they may have possessed (like discerning when brussels sprouts were ready to be picked). They were likewise concerned with breaking the labor process down into its constituent parts—leaf removing as distinct from ring knife jamming in brussels sprouts, for example—and disaggregating them when it was profitable to do so.

The innovations described above did not happen in a vacuum. While the end of the Bracero Program was an obvious incentive, so, too, was the growing militancy of workers in the 1960s and the eventual success of the UFW. Writing after a decade and a half of increasing labor strife, sociologists Runsten and LeVeen (1981, 67) argued that

> Over the longer run, union demands for better working conditions as well as higher wages may force labor costs up faster than productivity can be increased, and the only alternatives will be to find ways of increasing productivity through the use of labor-saving technology or to break the power of the unions; both alternatives are currently being pursued.

Productivity gains had already been impressive, as Margaret FitzSimmons (1986) detailed in her groundbreaking and foundational text on California's industrialized specialty crop production. FitzSimmons's (1986) article was the first in geography to focus on how it was through wrestling with and seeking to tame the contradictory relationship in capitalist agriculture between production time and labor time that such productivity gains were achieved (such studies are now commonplace: Henderson 1999; Guthman 2004; Walker 2004; Mitchell 2012). Of particular significance, FitzSimmons (1986, 347) showed, was the rise of subcontracting "producer services firms specializing in tasks such as soil testing, precision soil preparation and planting, pest and weed control, well drilling and irrigation system development and maintenance," each requiring "substantial capital investment and particular labor skills."[20] That is, it helps provide an explanation for the *disintegration* of agribusiness production that experiments in labor process transformation portended (predating similar processes of vertical disintegration rife across the industrial political economy of the US after the economic crises of the 1970s).

Yet FitzSimmons (1986), like so many other analysts of the time, seemed to miss how the disintegration of the labor process would entail a further disintegration of the rights of labor and induce even greater precarity among farmworkers. This was not foreordained, of course, especially in the Salinas Valley, the locus of FitzSimmons's research. From 1965 through the end of the 1970s, a multifaceted, often violent, class struggle raged in the fields of California, with the UFW and the Teamsters vying for contracts, growers signing sweetheart deals with the Teamsters when it suited their interests, significant capital (and political power) consolidation within particular crops, and more.[21] One eventual outcome was California's landmark Agricultural Labor Relations Act (ALRA) of 1975. Modeled on the National Labor Relations Act, but modifying it in a number of significant ways to both address conditions specific to intensive industrial agriculture and to strongly promote, not merely regulate, unionization in the fields, the ALRA sought to "bring certainty and a sense of fair play to a presently unstable and potentially volatile condition in the state" as well as "justice for all agricultural workers" (Cal. Labor Code § 1140). The ALRA created a set of rules for union elections that unleashed a flurry of organizing activity across the state. Struggles for union recognition and contracts were particularly intense in the Salinas Valley (particularly among skilled lettuce and other vegetable workers), especially in 1979 when the UFW won a string of elections. For analysts in the 1980s, the writing seemed to be on the wall: finally, workers had "now formed stable crews with internal discipline and a formal division of labor" and transient male, foreign workers were steadily being replaced by native and documented-immigrant workers (FitzSimmons 1986, 339). In most cases, UFW contracts included provisions for union-managed hiring halls, and two primary goals of the union were to de-casualize labor and to become the primary institution that controlled the labor supply, thereby greatly diminishing the role of FLCs (which

[20] Beginning in the early 1960s, when it became clear that the Bracero Program would be eliminated, University of California Cooperative Extension agents strongly advised farmers to use producer services whenever they could, as documents available in the UCCE archive as well as in the pages of *California Agriculture* readily show.

[21] Contemporary accounts and later histories of these struggles are legion. Perhaps the best overall history of the rise (and fall) of the UFW in California is Bardacke (2011).

UFW President Cesar Chavez described as a primary source of "evil" in the farm labor market [Levy 2007, 63]). Some contracts also included provisions regulating the introduction of labor-displacing technology.

Within a few short years, both in the Salinas Valley and across the state, however, the UFW had collapsed and lost nearly all of its contracts and the vast majority of its members. The reasons for the failure of the union were many, including significant internal failures of management, concerted grower opposition, and continued Teamster dirty dealing (Pawel 2009; Bardacke 2011; Garcia 2012). Also important was growers' increasing ability to recruit workers (frequently undocumented) from across the border, often using ethnically Mexican labor contractors, which greatly expand the pool of available labor. With the closing of the bracero pipeline, as Robert Thomas (1992, 73) put it, "the *indocumentado* floodgate [was] opened." Growers heavily recruited undocumented workers (and the state and federal governments turned a blind eye) not only because their illegal status made them all-the-more exploitable but also because they could be—and were—deployed as strikebreakers (Jenkins 1978; Pfeffer 1983; Ferriss and Sandoval 1997). As labor sociologist Max Pfeffer (1983) explained, the cultivation of a large reserve army of labor was a labor control strategy, and one in which FLCs gained increasing importance, whatever the efforts of the UFW. As Fred Krissman (1995, 22), a contemporary analyst of the growing importance of FLCs put it, "Rather than agricultural sector relocation [i.e., the relocation of agribusiness to Mexico], mechanization, or proletarianization, the traditional revolving door of new immigrant workers into the [agricultural labor market] has accelerated in the contemporary period." The new local labor control regime looked a lot like the older, pre-bracero one (McWilliams 1939; Fisher 1953; Daniel 1981; Fuller 1991; Mitchell 1996).

Yet if, however, mechanization is understood to be the concerted effort to rationalize *and simplify* the labor process through both labor-displacing (e.g., tomato harvesters and tree shakers) and labor-enhancing (e.g., labor carriers and brussels sprouts ring knives) technologies, as well as to transform other aspects of the means of production (replacing certain forms of labor with chemicals, reengineering the biology of plants, and so forth)—that is, exactly the massive program of research and innovation in agribusiness at the end of the Bracero Program—then Krissman is not quite right in his assessment. Mechanization was not made superfluous by growers' ready access, through FLCs, to a huge reserve army of labor; mechanization was instead a mechanism by which this reserve army could be deployed. By both displacing and enhancing, as well as simplifying labor, fears of a labor shortage shifted in the 1980s to public policy debates over how to handle a growing labor surplus (Martin and Johnson 1978). Through mechanization and other labor process interventions, coupled with efforts to encourage increased migration of undocumented workers over the border, growers were able to recreate conditions in which labor oversupplies—and thus a degree of certainty that enough labor would be in place when it was needed—once again prevailed.

Krissman was correct, however, in his assertion that this innovation in the farm labor market forestalled the proletarianization of farmworkers in California, at least if that term is understood to mean the transformation of peasant workers into a solidified working class, the kind of working class that rose to prominence and at least a degree of power during the era of industrial capital typically signified by the term Fordism. In all actuality, California agribusiness had never really been Fordist, whatever the

enthusiasm of the CCIH in 1922, and no matter how broadly that term is defined. While aspects of the industry were highly vertically integrated (the local term for big agribusiness—grower shippers—makes that plain), while wage labor (as opposed to family labor or sharecropping, for example) predominated in the fields of the state, and while the industry displayed an impressively detailed regionalization (Stoll 1998; Henderson 1999; Walker 2004), continuing discontinuities between production time and labor time assured that the difference between producing, say, heads of lettuce and carburetor heads remained significant. Fordism never quite dawned.

To whatever degree it had existed, though, Fordism was clearly now in its twilight and instead California farming's demonstration effect, as Krissman (1995) called it, helped show what a very different relationship between transformed labor processes, mechanization, and the struggle to control the labor supply could look like. As Margaret FitzSimmons (1986, 355) pointed out in the mid-1980s, "In the last fifty years specialization in agriculture has proceeded until the sector is best described not as a homogenous whole but as a complex set of specialized subsectors organized by commodity groups," which relied on contingent, nonunionized labor supplied and controlled by labor contractors. It was, in other words, the very apotheosis of the kind of *post-Fordist* industrial landscape that was attracting so much of the attention of economic geographers of the time.

Conclusion

Efforts toward labor rationalization, innovations in labor saving and labor enhancing technology, reorganization of the detailed division of labor, time-motion studies—in other words the remarkable investment in Taylorist efforts to transform the labor process in the California fields at the end of the Bracero Program—have to be understood as being, to a significant degree, efforts aimed toward enabling agribusinesses to regain their traditional rights to shape and deploy the labor supply as they saw fit, that is, to remake what Jonas (1996) called the localized labor control regime. Transformations in the labor process, like those attempted in brussels sprouts harvesting, cauliflower thinning, and tomato harvesting, were dialectically related to the construction and deployment of the labor supply. That this was so suggests that geographers should supplement their studies of the labor process—studies often geared at understanding the reciprocities between capital and labor at the site of production—with studies of how shifts at the place of production redound into the sphere of labor circulation. The local labor control regime not only conditions the labor process; the labor process conditions the labor control regime and is meant to. If, at the point of production, workers "rework seemingly deskilled positions" (Hastings and Cumber 2019, 1457), then those positions are often de-skilled (or otherwise remade) precisely to reshape *who* will do the work and under what conditions. In the case of California agriculture in the latter part of the 1960s, that reworking was designed to counter the growing power of the UFW and reassert the role of FLCs in the control and deployment of labor. Taylorist interventions led to something like post-Fordist outcomes.

These interventions were not uncontested. The UFW often tried to insert clauses when it won contracts insulating workers from the adverse effects of mechanization (even as Chavez thought the thoroughgoing mechanization of agriculture was inevitable

and even to be welcomed given the back-breaking and highly exploitative nature of farm work [Levy 2007]). And in 1984, the public-interest California Rural Legal Assistance (CLRA) and several other organizations sued the University of California and its Cooperative Extension, charging it with violating public trust and various provisions of federal law, by engaging in research aimed at displacing labor (Kendrick 1984). University of California researchers strongly rejected such claims (Martin and Olmstead 1985), but the records of the Extension Service and the College of Agriculture make it clear that displacing farmworkers was indeed an aim of the intensive period of research under examination in this article. The great irony was that, if anything, the intensification of production such innovations promoted helped to radically increase the number of farmworkers needed in the state, while further entrenching their precarity (Bugarin and Lopez 1998), in significant part because as tasks became disaggregated, labor time became shorter, even more discontinuous, and more intense. Eventually the University of California was forced to scale back its investments in mechanization (and related) research, but by then the die had already been cast. Taylorist interventions—forced on growers by the loss of bracero labor and the rise of the unions—had helped to thoroughly remake production and labor relations in the fields, making California agribusiness a model for the new industrial geography FitzSimmons (1986) was concerned with. Understanding struggles over the labor process are not only essential for understanding struggles over "the reciprocities negotiated between labour and capital at the site of production itself" (Hastings and MacKinnon 2017, 105) and the micro-geographies (Rainnie, McGrath-Champ, and Herod 2010) and cultures of work (Ellem 2016) these reciprocities engender. They are also, often primarily, struggles over the control and deployment of labor power and thus the shape of the productive landscape itself.

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