A REVIEW OF PIECEWORK

The HCI community has used the term "piecework" to describe myriad instantiations of on–demand labor, but this reference has generally been offered in passing. As this paper principally traces a relationship between the historical piecework and the contemporary crowd work (or on–demand labor more generally), this casual familiarity with piecework may prove insufficient. We'll more carefully discuss piecework in this section in order to inform the subsequent sections — and indeed, the entire argument. Specifically, we will 1) define "piecework" as researchers in the topic understood it; 2) trace the rise of piecework at a very high level, identifying key figures and ideas during this time; and finally 3) look at the fall of piecework, such as it was, considering in particular the factors that may have led to piecework's [MSB: (and crowd work's?)] [al2: I wanted to leave the door open later to argue that crowd work can change its trajectory and *not have a demise*. Is that too subtle here? I could have an aside like "(and help crowd work avoid the same fate)". Thoughts?] eventual demise.

What was piecework?

While "piecework" has proven difficult to concretize from the literature, we can trace a constellation of characteristics of piece work that recur throughout the literature. We'll follow the history of research, collecting descriptions, examples, and provided definitions of piecework, trying to trace the outline of a working understanding of *what piecework is*.

Raynbird offers a concise definition of piecework — which he variously also calls "measure work", "grate work", and "task work" — by contrasting the "task–labourer" with the "day–labourer": "...the chief difference lies between the day–labourer, who receives a certain some of money... for his day's work, and the task–labourer, whose earnings depend on the *quantity* of work done [emphasis added]" [16]. Chadwick gives a more illustrative definition of piecework, offering examples: "... payment is made for each hectare which is pronounced to be well ploughed ... for each living foal got from a mare; ... for each living calf got ..." etc...[3]. This framing perhaps makes the most intuitive sense; "payment for results", as Chadwick calls it, is not only common in practice, but well–studied in labor economics as well [6, 23, 24, 10].

It's worth acknowledging that "this distinction [between piece–rates and time–rates] was not completely clear–cut"; indeed, we see work that adopts piece–rate compensation in some aspects and time–rate compensation in others [9]. The "Rowan premium system", which essentially paid workers a base rate for time plus (the potential for) an additional pay dependent on output, was just one of several alternatives to stricter time– and piece–rate renumeration paradigms, which muddies the waters for us later as we attempt to categorize cases of piecework [20]. As Rowan's premium system guaranteed an hourly rate regardless of the worker's productive output *as well as* an additional compensation tied to performance, workers under this regime were in some senses "task–labourers", and in other senses (more [al2: (familiar|conventional)]) "day–labourers". [al2: I want to come back to this later when we talk about Uber & Lyft, and how they increasingly offer to guarantee drivers an hourly rate [see 22, 14]. That's why I'm nitpicking about this muddied system — to avoid someone saying "it doesn't seem like piecework to me anymore if there's an hourly wage floor"]

It may be worth thinking about piecework through the lens of its *emergent* properties to help understand it. Returning to Raynbird, several arguments for the merits of piece workcrop up; he points out that..."piece work holds out to the labourer an increase of wages as a reward for his skill and exertion...he knows that all depends on his own diligence and perseverance... [and] so long as he performs his work to the satisfaction of his master, he is not under that control to which the day–labourer is always subject." Raynbird (and others, as we will see) highlight the freedom from control that "task–labourers" enjoy [16, 20].

We see this sense of independence regardless of the time, locale, and industry. Satre offers us a look into the lives and culture of "match girls" — young women paid by piecework to assemble matchsticks generally in the late 19th century. Of particular interest was their reputation "... for generosity, independence, and protectiveness, but also for brashness, irregularity, low morality, and little education" [21]. J. Hagan documents piecework from 1850–1930 in Australia, finding similar assertions of the freedom compositors of newspapers experienced as piece workers: "If a piece–work compositor who held a 'frame' decided that he did not want to work on a particular day or night, the management recognised his right to put a 'substitute' or 'grass' compositor in his place" [11]. From these accounts we should be able to identify a sense of independence that resonates across decades, industries, and locales where piecework is found. We'll problematize this supposed advantage as we trace the history of piecework, but for now we can say that piecework affords independence and some sense of autonomy new to people in the working class.

Hart and Roberts offer another series of compelling insights toward the question of the features that sprout from piecework. In their reflection on the features endemic to piecework in the 1930s, which they describe as the "heyday" of piecework's prominence; among them were the following: 1) "female workers who generally had less training" had to be trained in narrower subsets of the general body of skills that conventional (male) apprentices would undertake, and 2) workers with specific slices of skills could be more appropriately matched to suitable tasks [9]. Piecework thus opened the door for people who previously couldn't participate in the labor market — either for lack of training or for other reasons — to do so, and to acquire job skills incrementally. Workers without conventional training — like women, who had no such opportunities to engage in engineering and metalworking apprenticeships as men did — could be trained very narrowly on a very tightly constrained task, demonstrate proficiency, and become experts in their own ways.

[al2: Without a summarizing paragraph here, I worry that people won't take essentially the topic sentences from each paragraph. That is, I want people to understand that piecework:

1. paid workers for quantity of work done, rather than time done;
2. was sometimes a little muddily defined;
3. afforded workers freedom that they didn't have before; and
4. enabled people who didn't even engage in the formal labor force to participate.

I wanted to kind of crystallize this, but if you think it's unnecessary, that's fine.]

The Historical Arc of Piecework

Piecework's history traces back further perhaps than most would expect. Grier describes the process astronomers adopted of hiring young boys to calculate equations in order to better–predict the trajectories of various celestial bodies in the 19th century [8]. While this approach didn't become an economic powerhouse as later examples would prove, Airy and others arguably found the kernel of insight that we pursue throughout this discussion: determining the extent to which work can be decomposed, and finding the limits of complexity of that decomposed work. That is, Airy found that he could train youths in elementary mathematics to complete the majority of the calculations he would otherwise have had to solve on his own, and that the greater body of work could ultimately be completed sooner if he arranged his work appropriately.

[MSB: After reading this paragraph, I don't know what it's supposed to be teaching me. What I got out of it is that a bunch of people did piecework, but I don't know why or in fact why these are different than the sources we cite earlier. Can you hone it?]

[al2: I wanted that paragraph to be about the rising popularity and application of piecework (especially as it approached its "heyday" (I like [9])), coming from humble beginnings as it found its footing. Given that intent...

Should I **refactor** or **rewrite**?]

First applied to farm work, as Raynbird and others illustrate, the practice remained relatively obscure until it was brought to the textile industry [16]. At the turn of the 20th century, when Riis was documenting abhorrent working & living conditions of pieceworkers in New York City, Norton was providing substantive guidance on various wage regimes, offering guidance on how best to manage pieceworkers [18, 15]. Clark, for instance, relays his observations of textile mill pieceworkers and his realization that "When he works by the day the Italian operative wishes to leave before the whistle blows, but if he works by the piece he will work as many hours as it is possible for him to stand" [4]. Best practices regarding the measurement and management of piecework rates, and of workers in the engineering industry, were beginning to take shape [2].

Researchers have since struggled to understand the mechanisms and characteristics in piecework which fueled its rise to popularity during this time. Graves argued that the first sparks of scientific management could be found in piecework; the approach of paying workers for each piece of output necessitated the rigorous tracking, measurement, and training of workers for which scientific management became famous [7]. This argument is certainly compelling; it would seem to make the concurrent upswing of scientific management and Fordism through the first two–thirds of the 20th century alongside piecework not only understandable, but predictable [9]. Brown inquired from another direction, asking what limited the adoption of piecework in industries that otherwise gravitated toward it (in the case studies he examined, this mostly focused on railway engineers), ultimately arguing that factors such as the nature of the work design (specifically, the homogeneity of tasks) and the costs associated with adopting a piecework model are likely major contributing factors the limited use of piecework [1].

As increasing attention revealed problems in piecework as it related to workers, workers themselves began to speak out about their frustration with this new regime. It began, arguably, with Riis's photo–documentary work, but this led to industry organizations representing railway workers, mechanical engineers, and others contributing their myriad perspectives [13, 17, 18]. Nevertheless, piecework continued to permeate low–skilled labor.

Piecework became an important contributor to the war effort in the Second World War, cementing its role not only in American factories, but in industrial work around the world. While piecework began to catch on at the turn of the 20th century, the 1930s represented a boom for piecework on an unprecedented scale, especially among engineering and metalworking industries. As discussed earlier, Hart and Roberts characterize the 1930s — and more broadly the first half of the 20th century — as the "heyday" of the use of piecework. He attributes this to the shortage of male workers, who would have gone through a conventional apprenticeship process affording them more comprehensive knowledge of the total scope of work.

Despite the intense growth of the piecework approach to renumeration, this time was not without turmoil. As previously discussed, a number of worker organizations weighed in on (or, more precisely, against) piecework and the myriad oversights it made in valuing workers' time [13, 17]. Satre describes worker resistance among a largely disempowered community — young women employed by piecework [21].

While many workers participated in piecework, worker sentiment toward the practice was — by all accounts — mostly negative. The match girls strikes which Satre describes were just one early — albeit critical — case study in this space; the national coal strike of 1912 led to an overwhelming vote among federated coal miner pieceworkers to strike for an individual minimum wage, among other demands [19]. Emmet documents a series of efforts among women in the garment industries in Philadelphia to negotiate collective bargaining rights and recognition of their own labor union [5]. The adoption of piecework time–study and other principles associated with Taylor and scientific management itself reliably precipitated strikes and more generally gave workers a clear enemy against which to rally [12].

Piecework's popularity in the United States and Europe plummeted almost as quickly as it had climbed just a few decades earlier. Hart and Roberts's work substantively ex-

plores the precipitous decline of piecework in the last third of the 20th century. In their work, Hart and Roberts offer a number of explanations for the sudden vanishing of piecework. We summarize some of the salient suggestions here: 1) the emergence of more effective, more nuanced incentive models — rewarding teams for complex achievements, for instance; 2) the shifting of these industries (manufacturing, clothing, etc…) to other countries; 3) the quality of "multidimensional" work becoming too difficult to evaluate. [9].

Why is piecework relevant to crowdwork?

[MSB: I assume this is forthcoming?] Using the definition of piecework that we came up with earlier, we argue that crowd work is fundamentally an instantiation of piecework, and that we can more precisely anticipate the answers to the open research questions we discussed earlier. We'll show that the dimensions of crowd work that the broader HCI community has been studying align with the history of piecework, and that this can greatly inform predictions about the future of crowd work.

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