Labor Gap Response Theory: Setting the Framework

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Abstract—Labor gap response theory is an interdisciplinary theory developed within anthroengineering that provides a framework for future research in assignment problems, policy effects on hiring, employee burnout mechanisms, and organizational stress. This paper outlines the major components of the theory and how together they can provide new methods for understanding contemporary issues in organizations. Within the context of manufacturing, the applications of industrial engineering and anthropology are explored in order to show how both fields approach discreteness and ambiguity and how they can be combined to propose novel methods. The paper goes on to discuss the analogy of materials engineering phase diagrams with their physical properties to that of organizational networks and properties related to stress. The paper ends with an example of a certain issue that raises questions with the perspective of the theory and what future work needs to be done in order to provide adequate models and solutions.

Keywords—industrial engineering, anthropology, phase diagrams, manufacturing, anthroengineering, assignment problems, fuzzy logic, networks, workload, burnout, turnover, liminality, doxa

I. Introduction

The U.S. is currently experiencing what is being referred to as a "Turnover Tsunami" or "The Great Resignation." According to data from the U.S. Department of Labor, 12.6 million workers quit their jobs in the third quarter (July-September) of 2021 with August being the all-time high [1-2]. However, this does not seem be the end of the trend. According to data released by Gallup, about 48% of employees are either looking for or keeping an eye on new work opportunities [3]. What makes this especially concerning, is just how many job openings there are. In the summer of 2021, there was a 6.9% job opening rate, a record high at 10.9 million job openings [4]. All of this occurring during the COVID-19 pandemic has left organizations scrambling to understand why people are leaving their organizations in order to best understand how to retain current employees and attract new ones. One topic that comes up frequently in regard to all of this employee turnover is that of burnout or work-life balance [5-8]. It may be easy to link all of these trends and burnout entirely to the COVID-19 pandemic, but prior to 2020, quit rates were already increasing annually [9]. With this in mind, it seems plausible to assume that organizations were already performing in unsustainable ways which the pandemic only revealed. The Turnover Tsunami phenomenon allows us then to open up a discourse about how jobs are organized in order to distribute work (labor) and how these organizations then respond to turnover or "labor gaps" at any point, not just during the pandemic. It is within this discourse that I introduce labor gap response theory (LGRT). In the following sections I explain what labor gap response theory is, its development, and potential applications.

II. Labor Gap Response Theory

In short, labor gap response theory, conceived within anthroengineering, posits that when a labor gap occurs in an organization, the response by the organization is shaped by its cultural norms and affects the sustainability of its human resources. It is an interdisciplinary theory developed with concepts from industrial engineering, sociocultural anthropology, and materials engineering which provides a framework and language to holistically observe organizations, assess their sustainability, make predictions, and provide solutions to maintain or increase sustainability. This theory could be considered adjacent to the concept of organizational resilience, which is situated within the field of business in management and organizational behavior. In that context, organizational resilience is much more concerned with the assessment, evaluation, and mitigation of risk through policy design and implementation [10]. However, this theory is constructed in order to understand the sustainability of a

human resource network (people) as it is affected by not only policy but also the labor network itself and how these all interact to reconfigure it. In the following sections, I discuss the different components that comprise this theory from their respective fields and how they fit together to provide multiple angles for understanding this relationship between people, organizational culture, and workload in order to better provide a background for assessing organizations through an anthroengineering perspective with one main question in mind:

When a labor gap in an organization occurs, how does the organization respond and what shapes or directs that response?

III. The Industrial Engineering Component

A. Nodes

Industrial engineers typically focus on the worker as a person who has to do certain tasks within a certain space. Then they "engineer" as much as they can within that space and the concepts of what "work" or "labor" are get collapsed into just tasks within a defined space, while only occasionally considering the interface between one workspace and another or between functional departments. This ignores quite a lot about the nature of the work they are designing around. That is not to say that industrial engineers *only* think about workers in this way. However, the majority of methodologies for analyzing work and workspaces generalize a fair amount and therefore cannot handle the other kinds of factors that define labor. Therefore, LGRT is meant to increase the scope of work evaluation and design to get a more systematic understanding of labor and its redistribution. But the wheel does not need to be reinvented, in fact, in methods engineering line balancing is a strategy which itself is really a way of organizing, or in a way redistributing labor [11]. This strategy quantifies the amount of time it takes to accomplish certain tasks in a manufacturing process being completed by any amount of workers and tries to "balance" the tasks amongst the workers so that each worker spends the same amount of time doing tasks. For example, if Person A spends 2 minutes doing tasks and Person B spends 4 minutes doing tasks then the goal would be to get both employees to spend 3 minutes each doing tasks. This can be done in various ways such as rearranging the tasks or minimizing task time.

What can be gleaned from these kinds of strategies is the notion that not all tasks within a process are necessarily already as discrete as we might initially conceive them. In fact, we might recognize that what methods engineering tools like motion time studies and stopwatch time studies aim to actually do is describe continuous processes as sets of discrete tasks to completed within discrete amounts of time. This can be problematic, as mentioned above, to conceptualizing labor which is not defined or cannot be confined discretely. So while time studies and line balancing can be useful for evaluating and designing discrete kinds of work, it is very important to understand from these methodologies that the discreteness itself is, to an extent, arbitrary but constrained by a multitude of variables such as time and space which serve as functions of cost or machine processes themselves. The main problems being solved then by current methodologies in industrial engineering are understanding what the constraints are and how to optimize within them. With this framework in mind, it is easier to conceptualize work away from the manufacturing cell and discreteness itself which is where LGRT focuses.

B. Networks

Above, the concept of discreteness is brought up not only to understand that industrial engineering attempts to develop discreteness within continuous processes, but to also show the arbitrariness of said discreteness. In fact, when first trying to understand labor in such discrete ways, certain problems arose. For example trying to define work as "blue collar labor" and "white collar labor" or "shop floor workers" and "office workers" did not suffice. In one workplace observed, these terms delineated who received certain benefits such as bonuses or sick days. But, in fact, the pandemic itself revealed that these terms do not actually fully describe the kind of work people do in the ways we expected them to. For example, in that same workplace, during the pandemic, some "office workers" were asked to stay in office in order to better support operations while the remainder were instructed to work from home. Some animosity ensued, with those who remained in office claiming that those getting to work from home did not deserve certain bonuses or sick days if they "weren't even important enough to stay in office", as one worker put it. This exemplified the need to describe labor in different kinds of terms. In studying the groups of workers, it became evident that the best ways to describe labor was through a labor network which tracked the relationships between workers and relationships to workspaces in a workplace. For example, manufacturing engineers, although considered "white collar" workers, had responsibilities to equipment and shop floor departments that required them to oscillate between the shop floor and their desk in the office area. In this way, defining their workplace discretely did not suffice. What this indicates, is that labor is best understood as a network of relationships to people or places that non-discretely

define the kinds and amounts of work to be done. This may seem to pose a problem for how we currently express networks or optimize based on discrete variables, but the use of fuzzy logic has been recently employed with the nurse scheduling problem [12]. Although this doesn't avoid discreteness entirely, that is not the goal of LGRT. In fact, this kind of use of fuzzy logic with a scheduling problem shows the usefulness and practicality of recognizing those variables related to labor which are not discrete.

IV. The Anthropological Component

A. Liminality

Whereas industrial engineering tries to develop solutions for efficiency in systems with discrete variables. Sociocultural anthropology recognizes how cultures, societies, institutions, etc. seem to possess stability and discreteness while continuously undergoing change and experiencing ambiguity. In this sense, this field is much more equipped at understanding the ways in which people and institutions experience non-discrete events. The most specific and practical application to LGRT being that of liminality coined by Arnold Van Gennep.

Van Gennep observed liminality in rites of passage, as periods of time that position participants outside of the day-to-day social structure while undergoing a change in status. It is precisely the "betwixt and between" or sense of ambiguity outside of the social structure in which the participant is neither their old status or new status that is liminality [13]. Although Van Gennep developed this concept solely with tribes and their rites of passage, Victor Turner further worked with the concept and developed the notion of the liminoid, which with respect to the liminal is very similar, with the marked distinctions being that the liminoid is both optional unlike the liminal and does not necessarily resolve ambiguity as in the liminal [14]. Turner's analyses, although tried to encompass more modern applications, focused more heavily on the liminal and liminoid as positive experiences. What Van Gennep made a special point about is that liminal experiences are very intense events, and because of that cannot exist for very long.

As an example that LGRT might consider in terms of liminality. Let us assume that in an imaginary organization a new employee (Nu) has been hired and they will be taking over some of an established employee's (Es) tasks and responsibilities. Both Nu and Es are experiencing liminality, but for this example we will only focus on Es. Es knows that when someone asks them about Task Z, which will be given to Nu, that they should still answer and help until Nu is able to provide support to that task alone. After some period of time, Es is still being asked about Task Z although they feel that Nu should be able to handle Task Z alone. Es is not quite sure about what their role and task profile should still include. Sociocultural anthropology might just observe that this is indeed liminality which Es is experiencing. But in LGRT the question arises for us to consider, when is it that Es should no longer feel responsible for this task and direct people to Nu instead of helping? Unlike in industrial engineering, the problem here is about removing the ambiguity and establishing discreteness. One way might be for their manager to say that after a certain date Nu is the direct contact for Task Z and that Es is only contacted if Nu is unavailable. With this example, it is easy to see how anthropology can make sense of the emotions and frustrations that arise when roles are not fully realized and in a state of flux as can occur during periods of high employee turnover in which a person may have to assume the roles of multiple people and then eventually return to a singular role. Yet, what determines how those roles and responsibilities are redistributed or even defined are best understood with another concept from anthropology.

B. Doxa and Habitus

In a very simplified way, doxa as used by Pierre Bourdieu is that which is outside of and opposite to the field of opinion [15]. These can be concepts or ways of being which are unquestioned and taken for granted as true because there are no "material" means by which they can be contested by being moved into the field of opinion. Fig. 1 shows Bourdieu's representation of this relationship. There is some disservice in describing it this way, but an example might be better suited.

Consider in the section "networks" above where employees were displeased that they had to stay in office while others got to work from home. A lot can be discussed there about doxa but let us just say that the pandemic provided a material means by which the assumption that all office workers were equal was now contested. Before, it was just assumed that all office workers were the same, they all went into work Monday through Friday and worked their 8 hours each day. The pandemic occurred and suddenly their bonuses and sick days were brought into the field of opinion with some claiming that since some of the office workers actually had to stay in office, they were more deserving of having these benefits, and those who worked from home should not receive them.

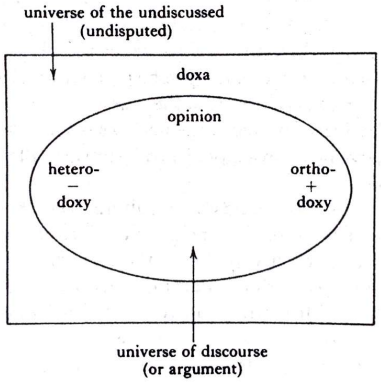

Fig. 1. Bourdieu's representation of the relationship between doxa and opinion

According to Bourdieu, those wanting to maintain the old established policy would be considered orthodox, while those trying to strip the workers from home of their benefits would be heterodox. What subsequently happened, was that no changes to bonuses or sick days changed for office workers, but all who had to work on-site in 2020 received a one-time lump sum of $1,500 as a "thank you" from the company. In all the discussion of fairness about compensation, another before unconsidered point came into contest, why shop floor employees had never received sick day pay before like office workers. Eventually, the company policy was changed so that all workers were entitled to 5 paid sick days a year. The habitus then is all that activity that occurs within the mental space of doxa. Everything is done as has been observed, with no question of the methods or attempt to change them, "that's just the way things are done". Because the habitus is formed cyclically, sick days were given to office workers and not to shop floor workers because "that's just the way it's been, that's policy."

The main reason for bringing this concept into LGRT is because it is crucial for understanding the expectations people have about certain jobs and their workloads or who is even deemed "appropriate" for doing so. In some cases, policy defines this and in other cases it is simply cultural expectations (in LGRT it is considered that policy and culture are somewhat interchangeable). It is important to consider these expectations to evaluate how employees feel about the work they do but also recognizing that those expectations can be shifted within reason. In one such example, a group of manufacturing engineers was struggling to finish a project because they were shorthanded. Since the project was deemed crucial, management asked in what ways they could be helped. Obviously, they understood that they wouldn't be able to hire another engineer reasonably soon, so it was asked if they could have someone from the shop floor to assist them with their other duties. This here was a very interesting move by the organization because it not only brought into question if engineers truly do a special kind of that work that only they can perform but in a much broader sense it brought into question what other kinds of labor are defined and distributed in these kinds of unquestioned ways. That possibility alone provides ample room for a myriad of non-discrete forms of labor that have not yet been established or defined.

V. The Materials Engineering Component

Materials engineering as a field focuses on developing new kinds of materials to solve certain kinds of problems, this can range from developing something like a more chemically resistant material or a new kind of fiber that transfers data faster. The applications are varied, but the example from which LGRT pulls is the subfield metallurgy. This paper won't focus too heavily on the science but what is most important to know is the phase diagram and how it is used to predict certain physical properties.

The iron-carbon phase diagram is one of the first complex phase diagrams that is brought up in introductory materials engineering courses. However, all that needs to be understood about it in this paper is that given a certain mix of iron and carbon and a specific temperature, a certain kind of structure can be expected in the material. At some points the material is all liquid, at other points it is part liquid and part solid, and at other points it is all solid (it may even be a mix of solids). The expected result can provide an insight into the physical properties of the material such as hardness or elasticity. The reason this concept is brought into LGRT is because structures in metals specifically can be described as networks or lattices of atoms. This is a useful analogy for showing that networks of people can also experience stress and fracture like materials. And that people, like atoms, with enough energy or stress can be effectively "ejected" from the material altogether. The second reason for using phase transformation as an analogy is because it can serve as a material way of conceptualizing liminality. The atoms in the material as it moves from one temperature to the next are in a certain kind of ambiguous period. Only when the final temperature is achieved is every atom then in its final state. However, things can be added or the temperature can be changed drastically instead of gradually. Both of these actions will have an effect on how the final structure manifests.

It is worth noting here that this is the least developed component of the theory because it requires more data and quantitative analysis, but it is believed that with sufficient correlation between variables in organizations and in materials, predictions can be made about certain properties in organizations such as "durability" or sustainability. It is considered promising considering the current application of such analogy between materials and communication systems [16].

VI. Framework In practice

In order to apply the concepts of this theory and show how it might be utilized to assess an organization and provide solutions, let us consider a small labor network.

In this labor network, there are three tiers: 1) manager, 2) manufacturing engineer, and 3) line lead. There is a single manager with three direct report manufacturing engineers each of whom are responsible for helping three line leads each. Fig. 2 visualizes this network. Now, imagine that one of the manufacturing engineers has left the organization. Let us assume that the organization has had a history of semi-lean practice [17] which means that the three manufacturing engineers were already spread thin. We will also assume the organization has a lengthy hiring process as many organizations do in 2021 [18] and that there is no understood interim plan for how tasks would be redistributed if one of the engineers left the organization.

There are multiple ways we could address this labor gap. Initially we might perceive this as an assignment problem, but the issue becomes that the way assignment problems are predominantly conceived are with discrete variables tied to certain discrete costs. Bringing in the anthropological perspective helps us recognize that the employees are experiencing liminality, they are at a point where they no longer perform the exact role they had before their coworker left and might actually have a different kind of role to perform after the dust has settled. And in fact, the line leads originally assigned to the engineer that left might approach either of the remaining engineers or the manager for assistance with a pressing issue. This can be extremely stressful and in fact, increasing the task load for anyone could push them "over the edge" so to speak.

LGRT would ask several questions here that could be very useful to assessing the organization and deciding how to reorganize the labor:

- How much more work are the remaining engineers in the network willing to take on before they feel overworked?

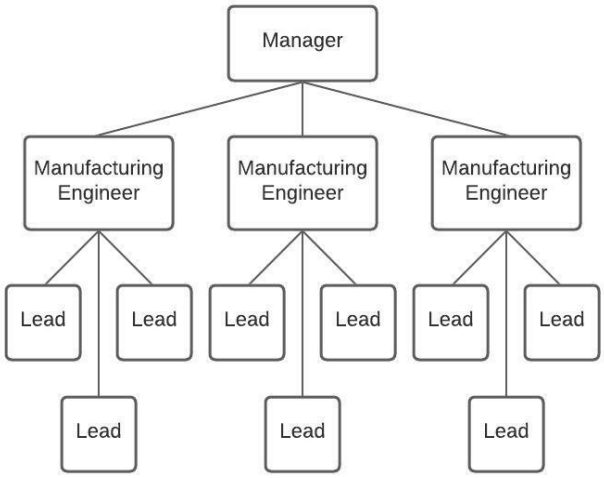

Fig. 2. Visualization of a simple labor network

- How long can the remaining engineers in the network take on extra work before they feel overworked?

- What are the non-discrete forms of labor that need to be redistributed?

- What defines these tasks as being "engineering tasks" and can they be distributed vertically?

- What is affecting how long it takes to hire a new engineer?

- Are there enough workers to reasonably do all the tasks required?

- Are some employees more overworked than others, why is that?

These are just a few questions, but from them different kinds of solutions could be provided. Perhaps the time it takes to hire a new engineer is too long, and the hiring policies or procedures that contribute to this need to be changed. Instead of using just cost in a matrix in a discrete assignment problem, fuzzy logic is incorporated with expectations of workload to instead assign tasks based on their perceived workload. In this way the matrix is comprised of "high", "medium", or "low" workload tasks and the "cost" is defined by its likelihood to produce burnout, again using fuzzy logic. The organization could be evaluated based on number of employees, their perceived workload, and current burnout levels to predict in which department a labor gap would produce higher levels of stress.

VII. Conclusions and Future Work

As exemplified in the previous section, using an interdisciplinary theory to assess problems in

organizations can provide a multitude of possible approaches to addressing those issues. Such approaches can include modifications to current algorithms or matrices for assigning tasks, quantifying the relationships between hire times, workload, and burnout, or using employee count and expected labor output to determine organizational stresses. In fact, it is these three concepts that will comprise much of the future work for legitimizing the applicability of the theory. The easiest seems to be the application of fuzzy logic to assignment problems and algorithms for which work already exists. The second easiest might be the quantification of the relationships between hire times, workload, and burnout. My work will focus on this next due to my proximity to the field of the methods engineering subfield and anthropology. Thirdly, developing a method to evaluate networks and organizations as an abstracted type of material might be the most difficult. However, as I've mentioned, there is already some work on this being done. But it might be useful to further explore cascading failures in human networks as some scientists have studied [19], but that is currently the farthest reach of my scope.

The initial framework for defining labor gap response theory provides ample room for research that borrows from both anthropology and engineering. This positions LGRT well within anthroengineering and gives even more reason for the establishment of the field as others are attempting in different capacities [20]. This paper is only a launching point and does not fully encompass all the ways that labor gap response theory could be further or more richly defined. It is my sincerest hope to further establish it within anthroengineering and across domains to provide new kinds of solutions to age old problems experienced in organizations.

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