Case Study: Emergent Cognitive Architecture in the *"Dabbawalla"* System, a massive social entrepreneurship organization.

By Karishma D'Lima

When first presented with this topic, my mind immediately flew to my hometown, Mumbai in India. A bustling city with 12 million people has sprouted an intricate food delivery system, originating in 1890. This would be an ideal case study for the social organization of distributed cognition. A "dabbawala", literally translated to "tiffin delivery man", is a person who collects hot food in lunch boxes from residences and delivers it to the workplace of their customers everyday. They collect the empty boxes that same day, and return them back to their respective homes. This system employs thousands of people. They use cost efficient modes of transport, predominantly cycles and local trains. The average literacy of a dabbawala is that of an 8th grader which makes this historical organization so unique. In spite of this, they have created a reliable, cost effective system that provides you with hot, fresh, hygienic food in the middle of your work day. In this essay, I will show how the dabbawala system utilizes a simple coding scheme that gives rise to various mechanisms of social coordination to distribute tasks and information across people and time. This results in an emergent system property that successfully accomplishes this complex task.

The system has produced efficient mechanisms of coordination in order to successfully manage the colossal number of items to be delivered. Between 175,000 and 200,000 lunch boxes are moved by 4,500 to 5,000 dabbawalas for a fee of about $8 per month. Moreover, the average dabbawala is not fully educated, therefore

simplicity is key. The boxes that are delivered have several different markings on them: abbreviation for collection points, color code for the destination of the box and markings for the dabbawalas located at the destination, that is, building and apartment number.

This coding system has created masters of supply chain management. They follow principles of a production system, where specialists act when confronted with a condition (Marghetis Lecture). The collecting dabbawala travels on bicycle to the residences and collects the hot food. The code is first utilized by him to take all the collected boxes to a designated sorting area. Here, the boxes are sorted and bundled into groups, by him and other collecting dabbawalas, for further transportation. These groups are marked with a code for the destination station and the dabbawalas load all the boxes in the coaches of trains. Each coach is usually designated for a specific set of destinations. Along with a code for the destination station, there are other markings for the destination building delivery address. At each station, boxes are handed over to a local dabbawala, who delivers them. This process is then reversed as the empty boxes are collected after lunch and sent back to the respective houses. Each dabbawala follows the instructions pertaining to his leg of the journey, which will be followed up by the next dabbawala, thereby creating global complexity from local ignorance.

The information is managed in a totally distributed system, between people and their environment and among the people themselves. The artifact (the coding system) utilized is on the box itself and is reliably present in the environment whenever it is needed. None of the workers have to rely on any cognitive resources

like memory. The artifact allows *all* the information necessary for every step of the process to be placed on the box itself, accessible to each individual. The attentional flow is directed by the coding scheme on the box, creating dynamical informational flow between the the worker and his environment. The efficiency lies in the routine and cognitive underloading. This is accomplished by dividing workers to perform specialized tasks while the material artifact provides directions for every one of these tasks. The coding scheme allows for information to be propagated in a simple and effective manner that enforces cognitive underloading and reliance on external cues in the environment. It is a system where the information about where the lunch box needs to go is always accessible to the particular dabbawala who needs it and the rest is left up to the next dabbawala who will receive all the information he needs, provided he is at the designated pickup area to receive the lunch box. In this way, the what, where and when of the information propagation system is distributed such that the information is accessible to the specific dabbawala that has the box in hand when he needs the information. It is done this way so the system can accomplish its goal with no extra communication required and enables an efficient method that provides the knowledge and information to each person in the system when required. The limited education of the workers requires for the information to be propagated in a simplistic, understandable manner. The dabbawala delivery system distributes distinct tasks with a simplistic coding scheme across a multitude of individuals. This allows for the necessary information to be propagated efficiently, scaffolded by the material artifact which transforms the capabilities of the individuals working in the system.

The emergent properties are apparent as the working coordination of this system allows for this complex task to be performed by a few people that rely on

routine and coordination. The task occurs within a decentralized functional system. That is, the work is distributed across people and time with all information required accessible, provided routine and order is followed. Each dabbawala only travels a small part of the journey, the multiple exchanges of food allow the box to get to the consumer and back home in time. This is a unique system property that emerges from the combined and distributed efforts of the individuals. It is an extraordinary example of a distributed system because there is no centralized controlling system that any of the individuals are answerable to. Rather, the system as a whole works on the principles of a production system and utilizes stigmergy, which focuses on indirect coordination between agents where the trace of an action left in the environment propagates the next action (Marghetis Lecture). This distributes the responsibility, maintaining robust system accomplishments that have intersubjectively shared understandings of the task which enables individuals filling in for each other. Quality of service is one of the emergent properties exhibited because this task would not be as reliable or cost and time efficient if one person were assigned the whole task. It would require many more people if each person were to handle one delivery. The system wouldn't be as widespread as the consumers would be divided based on each dabbawala and his individual services. The individuals that comprise the system have properties different from the properties of the system as a whole. They are transformed by the use of the artifact in providing reliable information available in the environment and by the social distribution and organization of the system that assigns specific tasks to specific members.

Upon analysis of the dabbawala system, a weakness in the outlined methods of coordinating distributed parts in a system arises. None of the mechanisms of

coordination outlined, factor in the potential of culture and spirit to coordinate a system. The dabbawalas all come from a particular group of villages, who draw great motivation from their service, that they view as an act of worship. Providing sustenance to other people, all of whom are God's creations is a form of worship. Their "company mission" which is dedication to the service of providing food in show of worship is a major factor that contributes to the efficacy of their work and the success of the distributed system.

It is without a doubt that this complex network of food deliveries relies heavily on the combined coordination of many people. However, at the heart of it's efficiency is it's simple coding system that gives all the information required in an easy and accessible manner. A non-distributed system would be an inefficient delegation of tasks that would require a large workforce to provide all the deliveries, making each person wholly responsible for specific deliveries. This would reduce the interchangeability of the workers in the organization making it less robust to change and error. This system distributes the task responsibility among the group. It employs mechanisms of coordination that transform the task into a simple perceptual task that relies only on a simple code on a box and a small group of people who are socially coordinated to produce one cohesive cognitive functional system.

Note:

This case study was written with reference to principles about Distributed Cognition taught by Tyler Marghetis, and Ed Hutchins' scholastic work..