TEMPERATURE REGULATED CONTAINER

FOOD STORAGE AND SOCIAL INTERACTIONS

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction

In 1802 a Maryland farmer named Thomas Moore came up with an oval tub that he named the refrigeratory (Greg, 2020). Since then refrigerators and food storage technology has developed with better insulation materials and a greater variety of containers for a variety of needs. While refrigeration as a concept did not come until the 1800s the idea of keeping food and drinks fresh for long-distance transportation or preservation has been around for thousands of years (Greg, 2020). People have preserved and stored their food for centuries (Krasner-Khait, 2011). This is because food is necessary for survival. Some of the first food preservation methods came from nature, depending on the climate humans either freeze meat in ice or dried food in the sun (Nummer, 2002). Nowadays there are many different food storage devices that help keep food fresh and safe for consumption.

There are around 76 million cases of foodborne illness annually (Dols et al., 2001). Four steps that can be taken to lower your chances of food poisoning are to clean, separate, cook, and chill (Centers for Disease Control and Prevention, 2020). With hot or cold food it is important to keep these foods at the correct temperature. For cold food it should be kept at 41F or lower in the refrigerator and 0F or lower in the freezer. For hot food it is recommended to keep them at 140F (Meredith, 2021). The range between these temperatures is called a danger zone because this range is the ideal condition for bacterial growth which is the cause of most food borne illness, if food is kept above 140F or below 41F then the bacterial growth decreases (Gowtham et al., 2018). Refrigeration helps slow down the activity of bacteria, for example in milk bacteria will spoil milk within two to three hours if left at room temperature. If the milk is placed in a refrigerator the reduced temperature will help keep the milk fresh for a week or two. In addition if the milk is frozen it can stay fresh for months (Brian et al., 2006). This becomes a bigger

problem when needing to transport food from one place to another since things like refrigerators are stationary.

The technical topic is to create a temperature controlled environment that is controlled by Peltier modules that are known as solid-state cooling devices since they use metal to transfer thermal energy (U.S. Department of Energy, 2022). These Peltier modules will help to both heat or cool an enclosed environment to a specific temperature controlled by the user. Food storage technology can help fight against food borne illnesses but they have also been a factor within social interactions, both at the global and individual scale. Through technological determinism the effect of food storage development on the facilitation of human interaction will be analyzed later in the paper. Food storage devices play an important role in human society from keeping food at safe temperatures for consumption to helping advance human interaction at the global and individual level.

Thermo-Stasis

Using thermoelectric cooling units this project aims to create a temperature controlled container that can both keep things cool or hot. Since the container is battery powered it allows for easy transportation of the device. This device will help prevent bacteria from causing food/beverages to spoil and allow for safe consumption.

The goal of the project is to implement thermoelectric cooling units also known as Peltier devices to create a stable thermally regulated environment, capable of both heating and cooling for food and beverages. Peltier devices are made of p and n type semiconductors placed between two ceramic plates (Sharma, 2014). These devices employ the Peltier effect, which is when a voltage differential is applied an electric current passes through two conductors that will cause

heat to be generated or absorbed at the junction depending on the current direction (Eibl et al., 2015). In other words one side will be cooled while the other heated, changing the direction of current changes which side is hot or cold. Along with using Peltier devices to implement our design another major component of the project is the amount of heat dissipation. Both the heat within the container needs to be moved and the heat generated by the Peltier modules needs to be dealt with. To do this heatsinks and fans will be incorporated on both sides of the Peltier module to assist with the heat movement within the system (Posobkiewicz, 2021).

The main component of the technical project is the Peltier devices which were chosen since they offer several advantages compared to other food storage devices. Most food storages like refrigerators and coolers are able to only cool food, but keeping food hot is also a way to keep food safe. Through the ability of the Peltier device to change which side is hot and cold the proposed device will be able to both heat and cool, so there would be no need for two different storage containers. Peltier devices are also more environmentally friendly, they don't have many parts, are small and portable and they help with precise temperature control, which is needed when the project has the user set a desired temperature for the container (Sharma, 2014). For these reasons Peltier devices were chosen to help construct a thermally regulated container to help keep food at safe temperatures to avoid bacteria growth.

Determinism & Food Preservation

Food preservation technologies have helped humans be able to store and consume food in a safe manner but they have impacted human societies in other ways. Food preservation technologies helped early humans to make roots and form communities. In addition to helping early humans enter a sedentary lifestyle, food preservation also enabled exchange and long

distance trade (Higman, 2011). Later on with cold storage warehouses and refrigerator cars the availability of food that was once affected by the seasons and distance decreased (Freidberg, 2014). Along with the global effect that food preservation and processing have, they also have small scale impact within communities because they help create special food for cultural or religious occasions, which reinforces cultural identities (Fellows, 2004). Within studies conducted in food preservation practices and motivation there have been some notable findings including the impact food preservation had on relationships and deep connections. Through the act of food preservation (mainly canning) participants found that it helped them build relationships and strengthen bonds with the people they preserved food with (Click et al., 2010). This all can be accumulated to the question of how food storage technologies have helped facilitate social interactions between societies and individuals over time. This research question would be analyzed through the lens of technological determinism.

Technological determinism is the idea that technology has the ability to effect and change our lives. Within technological determinism there is a range from hard to soft determinism. On the side of soft determinism there is the idea that technology can influence society but not necessarily that technology is autonomous (Hallstrom, 2022). Soft determinism is the idea that technology developments are embedded in social, political, economic, and other processes. Past technology developments shape the present, but individuals and groups can still exert control over these technological developments (Cockfield, 2010). Through a study investigating the impact of technology, through activity tracking devices, on a user's attitude towards pursuing an active lifestyle, the findings suggest that the relationship between technology and human behavior is not linear and that the dynamics between the two are complex and ambiguous. Even though technology can affect human behavior it is not the only factor controlling it (Sharma,

2014). In the article by Sally Wyatt (2008), she talks about technological determinism and that alongside technological progress is social progress. This can be seen as food preservation technology developed humans were able to develop as well. Humans developed by settling down and creating communities. With the inventions of food preservation technologies for long distances, exploration was able to flourish which led to an interaction between different cultures. Determinism can appear at all levels, micro and macro levels of society (Hallstrom, 2022). Through this idea storage technologies' effect on social interaction will be investigated at the global level and individual level (everyday lives of U.S. inhabitants). When looking at technology people are usually somewhere on the spectrum between instrumental and substantive theories. On the side of instrumentalists, people believe in individual autonomy, and they view technology as having a neutral impact on human affairs.The other side, substantive, believes that technological systems have a substantive impact on individuals and communities (Cockfield, 2010). Soft determinism is somewhere between the two points that help explain how technology affects society but that technology is not exempt from input by outside forces.

Research Question and Methods

The research question being analyzed is how have food storage technologies integrated within society to facilitate interaction on the global and individual level. Knowing how food storage devices have decreased the distance between people and facilitated interactions can be useful in the present time. An example is that there has been research that shows a relationship between social interaction and mental health (Lin et al., 2022). If food preservation has helped increase social interaction can this knowledge be used in everyday life to help with an individual's mental health. This topic will be analyzed through historical analysis that looks at

food storage technologies both in the past and present. Through historic data the impact of food storage technology will be found both on the globe and individual impact. In addition to analyzing food storage across time the topic will be analyzed by looking at food storage across different geographies. People don't think much about how refrigerators have improved their diets and lives but they also don't think how refrigerators are not the only method people around the world use to store food. One such device is the Zeer pot that is a non-electrical evaporating cooling device used by people in rural Africa and the Middle East to keep vegetables fresh (Missigman, 2017). By looking at different geographies, food storage technology will be analyzed to see how these different technologies affect the culture and people that use them.

The collection of data will be done by surveys and prior literature. Surveys will be used to get information regarding how people store food and what types of food preservation techniques they use. The survey will also ask questions regarding how much food storage is prevalent in people's minds and what types of events they bring/take food to. The survey will be conducted within the context of the U.S. The results of the survey would be combined with prior data on food storage technologies to help analyze the research question through the lens of soft determinism.

Conclusion

The problem that the technical solution solves is the development of food borne illnesses due to not having food and beverages in the correct temperature, this problem is especially prevalent when in a situation where no stationary containers, like refrigerators, are located. The technical solution is a thermally regulated portable environment that can be heated and cold. This will help fight the problem of food borne illnesses. The technical solution looks at storage

technology and health but the social component looks into how storage technologies have affected social life in the way humans interact with each other both on the global scale and the individual scale. Through the viewpoint of soft determinism the goal is to show that over the course of time as storage technologies have developed they are associated with a growth in human communication and advancement. This will help bring into focus on how food store technologies have been a large player in human interactions even though most U.S. people don't have to think about how they will store their food.

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