Impacting the bottom line: Behavior mapping in a full-service hotel kitchen

by

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Abstract

The study at hand sought to demonstrate the value of spatial layout and functionality in the foodservice industry and the impact these components have on productivity, employee satisfaction, and ultimately the bottom line. This study introduced a method for further research to be conducted in an attempt to limit the productivity hindrances of excessive walking, product rehandling, and cross traffic/confusion. This work additionally sought to explore behavior mapping as a research tool that can be used by both interior designers and food service professionals to establish a benchmark for observing and identifying key productivity hindrances in the physical environment in a full-service hotel kitchen. The researcher theorized that a paper-based survey combined with researcher-conducted behavior mapping would produce more descriptive results than the survey method alone. Paper-based surveys included a self-reported employee behavior map portion that in combination with researcher-conducted behavior mapping did in fact produce greater results than the paper-based survey alone. The results uncovered about the productivity hindrances led to potential solutions to be developed for the full-service hotel kitchen. The results of this study add to the body of knowledge for both the foodservice and interior design industries in the spatial layout and functionality component of the physical environment.

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Introduction

One of the top issues facing the foodservice industry is employee turnover. The issue of employee turnover is not a new concept: keeping kitchen staff around has been a challenge for executive chefs and upper management for decades (Hinkin & Tracey, 2000). In understanding turnover, job satisfaction remains one of the toughest characteristics to identify but remains one of the most important constructs in understanding why foodservice employees leave their jobs (Ghiselli, La Lopa, & Bai, 2001). There are many factors that contribute to this lack of job satisfaction. Some examples of these factors include need for achievement, chance for advancement, compensation, creativity and working conditions (Quinn & Staines, 1977). Interior designers use expert knowledge in order to design interior environments that improve the working environment and meet the needs of the end users while satisfying the financial limitations of the organization. In this manuscript, the researcher will suggest that the state of the foodservice industry could potentially be improved by using the expertise of interior design knowledge to impact the physical environment aspect of working conditions and therefore impact employee turnover and productivity. The biggest challenge in bridging the communication gap between interior designers and foodservice industry personnel is a lack of common knowledge in order for both sides to communicate their ideas successfully. The body of knowledge for both industries addresses similar topics, but the languages used in both is different, making the transition from one body of knowledge to the other difficult. Benchmarks, or standards, are needed in order to lay the groundwork for these two industries to communicate successfully. When searching for literature on the impact the physical environment, environmental conditions and spatial layout and functionality have on productivity in the foodservice industry, the researcher found little published research on these topics. As will be

further described in the literature review, a generic benchmark for both the interior design and the foodservice industries for the topics of spatial layout and functionality in a full-service hotel kitchen does not currently exist.

Purpose

The purpose of this study is to aid interior designers and food service professionals by adding to the body of knowledge in spatial layout and functionality. An additional purpose is to test a research tool that can be used to establish a benchmark for observing and identifying key productivity hindrances of the physical environment in terms of spatial layout and functionality in the foodservice industry. These hindrances are drawn from the literature (Kahrl, 1975) and were used as variables during this study:

- Excessive walking
- Product rehandling
- Cross traffic/confusion

Justification

There is little published research in the topic areas of the physical environment, environmental conditions, and spatial layout and functionality and the impact these aspects have on productivity in the foodservice industry. The researcher proposes that the interior design industry can make use of the tool of behavior mapping when collaborating with the foodservice industry. This tool may be used to aid professional practice by identifying the hindrances of excessive walking, product rehandling, and cross traffic/confusion in the pre-design or post-occupancy stage. It may also be used as part of an evidence-based design process that results in published research in the topic area of spatial layout and functionality and its impact on productivity. Further, using a combination of discovered solutions in published literature and

the tool of behavior mapping, upper management may be better able to retain employees by improving the physical environment aspect of working conditions.

Research Questions

The researcher's overarching question is: How can interior design research use behavior mapping to help the foodservice industry in improving the bottom line? The researcher seeks to answer the following research questions in this manuscript:

RQ1: Can the productivity hindrance of excessive walking (Kahrl, 1975) be observed through:

(A): researcher-conducted behavior mapping in a full-service hotel kitchen?

(B): employee self-reported behavior mapping in a full-service hotel kitchen?

RQ2: Can the productivity hindrance of product rehandling (Kahrl, 1975) be observed through:

(A): researcher-conducted behavior mapping in a full-service hotel kitchen?

(B): employee self-reported behavior mapping in a full-service hotel kitchen?

RQ3: Can the productivity hindrance of cross traffic/confusion (Kahrl, 1975) be observed through:

(A): researcher-conducted behavior mapping in a full-service hotel kitchen?

(B): employee self-reported behavior mapping in a full-service hotel kitchen?

RQ4: Does a paper-based survey combined with behavior mapping result in more descriptive behavior findings than a survey method alone?

Definition of Terms

The researcher has provided these definitions of terms that may be unfamiliar to the reader or that may have varying definitions within the existing literature. For added clarity, each

definition is followed by an example of the term's use.

Back of house (n.): Work area where staff that is responsible for producing the food to complete their tasks (Ingram & Jones, 1998). Back of house (BOH) employees rarely have interaction with customers.

Behavior mapping (n.): Behavior mapping is an objective method used to investigate the physical attributes of the built environment in association with observed behaviors (Cosco, Moore, & Islam, 2010). See also "place-centered maps." In the literature, behavior mapping and behavioral mapping are used interchangeably to refer to the same method. To avoid confusion, this study used the term "behavior mapping" to describe the method used to observe and record data. Example: In this study, the researcher used the tools of behavior mapping, both observed and self-reported, and a paper-based survey to complete step two of the method.

Behavior map (n.): "An actual chart of an area on which people's locations and activities are indicated" (Guerin & Dohr, n.d., p. 4). Example: The researcher held a clipboard with many copies of the kitchen plans while conducting observations of the employees' behaviors. The plans turned into behavior maps after the observations of employee behaviors were recorded.

Benchmarking (n.): "A continuous, systematic process for evaluating the products, services, and work processes of organizations that are recognized as representing best practices for the purpose of organizational improvement" (Spendolini, 1992, **p.9**). Example: Surveys were passed out and meetings were held as a part of internal benchmarking in order to determine the best way to attract new clients to the law firm.

Bottom line (n.): "the line at the bottom of a financial report that shows the net profit or

loss" (Merriam-Webster.com). Example: The employer did not care that the employees were exhausted from all the extra holiday business because the bottom line was growing. Note that sources from the literature review (Young & Corsun, 2009; Hinkin & Tracey, 2000; Abbasi & Hollman, 2000) make use of the term but do not offer a definition.

Cross traffic/confusion (n.): An inhibitor of productivity in which employees bump into each other or are forced to wait while another employee crosses their path of travel (Kahrl, 1975). Example: The more cross traffic areas a kitchen has, the more likely it is for employees to run into one another causing a mess or being a potential safety hazard.

Employee turnover (n.): The process of employees leaving one organization for another organization or moving into a state of unemployment (Hom & Kinicki, 2001). Also known in the literature as worker turnover (Burgess, 1998), labor turnover (Rowley & Purcell, 2001), and labour churn (Rowley & Purcell, 2001). See also "turnover." Example: Although a lot of research has been conducted on employee turnover, few solutions have been uncovered to combat this problem within organizations.

Environmental conditions (n.): Environmental conditions (also known as "environmental dimensions" in literature) fall under three categories: ambient conditions, spatial layout and functionality (also called space/function), and signs, symbols and artifacts (Bitner, 1992). Example: "It behooves us in equipment and kitchen design and foodservice operations to recognize the environmental conditions under which man performs best and then provide what he needs to maximize his performance" (Avery, 1965, p.74).

Ergonomics (n.): "the science of designing the job to fit the worker, rather than physically forcing the worker's body to fit the job" (OSHA, 2000, p.1). Example:

Ergonomic research was conducted to determine the optimum height for a standing work surface for a chef to complete a series of prep work tasks.

Evidence-based design (n.): "The process of basing decisions about the built environment on credible research to achieve the best possible outcomes" (EDAC, 2008, para. 1). Example: Evidence-based design bases design decisions on credible evidence. The term evidence-based design is commonly known as EBD.

Excessive walking (n.): An inhibitor of productivity in which the employee walks more than necessary to complete a task efficiently (Kahrl, 1975). Example: An employee that walks excessively is wasting time and energy because the employee is producing only when standing and using the hands (Kahrl, 1975).

Exit (v.): The behavior of an employee switching from performing a kitchen behavior to departing the kitchen zone. Example: An employee stops stirring a pot on the stove and exits into the dish pit. On the behavior map, the researcher labels this behavior "exits."

Explicit knowledge (n.): "Knowledge that is written, easily communicated, and often contained in policies, procedures, or rules within organizations (Kacmar, Andrews, Van Rooy, Steilberg, & Cerrone, 2006, p. 135). Example: Explicit knowledge is knowing facts (Grant, 1996).

Front of house (n.): Work area where staff that is responsible for serving the food completes their tasks (Ingram & Jones, 1998). Front of house employees typically have outgoing personalities, which is a benefit when dealing with customers face-to-face.

Full-service restaurant kitchen (n.): An establishment where employees provide "food services to patrons who order and are served while seated and pay after eating. These establishments may sell alcoholic beverages, provide take-out services, operate a bar or

present live entertainment, in addition to serving food and beverages" (NAICS, 2007, Section 722110). Example: A full-service restaurant kitchen has to be different from a fast food restaurant kitchen because it serves customers who are purchasing a different product, produced differently, and at a different pace.

Full-service hotel kitchen (n.): A kitchen that conducts all of the functions of a full-service restaurant as well as providing dining services, such as banquet and in-room dining, to accommodate hotel patrons. Example: When choosing a hotel while on vacation, the family decided to stay in a hotel with a full-service hotel kitchen in order to have all their dining needs met without having to leave the property.

Hesitate (v.): The behavior of stopping and pausing for no apparent reason. Example: The employee walks toward the oven, hesitates, and exits to the dish pit.

Identified naturalistic observer (n.): An observer who does not intervene in the behaviors conducted by the people being observed and is identified and openly viewed by the employees. Naturalistic observation is defined as "a study method that involves covertly or overtly watching subjects' behaviors in their natural environment, without intervention" (Fournier, 2010, para. 1). Example: The researcher acted as an identified naturalistic observer in the sense that the kitchen staff knew the researcher was present but the actions of the researcher had no impact on the employee's work processes.

Job satisfaction (n.): "The pleasurable emotional state resulting from the appraisal of one's job as achieving and facilitating the achievement of one's job values" (Locke, 1969, p. 316). Example: When an employee is no longer experiencing job satisfaction in their work, the likelihood of seeking new employment is high.

Kitchen behaviors (n.): Individual movements conducted by an employee to complete

their specifically assigned function. Example: Pouring flour into a mixing bowl would be a kitchen behavior conducted commonly in the baking kitchen function.

Kitchen function (n.): A combination of kitchen behaviors conducted by the employee; the task the employee is assigned or instructed to perform by management. Example: Baking is a common kitchen function.

Kitchen zone (n.): A division of the physical space, separated by physical walls, identified by the researcher in order to observe different areas within the full-service hotel kitchen; these areas are where kitchen functions occur. Example: The bakery is an example of a kitchen zone in the full-service hotel kitchen where this study was conducted.

Kitchen subsection (n.): A division of a kitchen zone in which kitchen functions occur. These subsections are identified by the researcher and defined by the behaviors that occur within them. Example: Excessive walking could be avoided if the employee had all the necessary resources to complete the kitchen function of pizza making in the pizza subsection.

Method (n.): The process in which systematic steps are taken to produce data that can be studied to form conclusions. Example: In this manuscript, the researcher proposes a method to produce literature in the area of spatial layout and functionality of a full-service hotel kitchen.

Place-centered maps (n.): "Refer to how people use a specific space. The type of mapping can be unobtrusive and is good for public spaces. Observers watch the actions in a particular behavior setting and record them on diagrams or plans" (Guerin & Dohr, n.d.). Example: The researcher used place-centered behavior maps to record the actual

behaviors being conducted in a space that can sometimes be different from the intended behaviors of a space.

Plan (n.): A commonly accepted term used to describe a scaled diagram that shows the arrangement of furniture and equipment of a physical space. Example: Interior design students spend a lot of time putting their design ideas into easy-to-understand plan form.

Point of collision (n.): The point in the physical environment at which two employees meet in the same place at the same time. Example: The point of collision in front of the ovens is a dangerous place because if one cook is pulling something hot out of the ovens, another cook could get burned.

Process (n.): The series of actions followed by employees in order to reach a specific goal. Example: There are always improvements that can be made to the process used in a full-service restaurant kitchen.

Product rehandling (v.): An inhibitor of productivity in which an employee touches food, supplies, and dishes more than once (Kahrl, 1975). Example: To investigate product rehandling, radio frequency identification tags (RFIDs) can be used to alert the researcher regarding how many times an employee comes in contact with a specific product.

Productivity (n.): A widely accepted concept defined as the relationship between input and output (Tangen, 2002). Example: "Productivity is a performance measure that can be defined as the effective use of resources to achieve operational goals" (Reynolds, 1998).

Qualitative case study (n.): "An approach to research that facilitates exploration of a phenomenon within its context using a variety of data sources. This ensures that the issue is not explored through one lens, but rather a variety of lenses which allows for multiple facts of the phenomenon to be revealed and understood" (Baxter & Jack, 2008, p. 544).

Example: When reporting results of a qualitative case study, the researcher must turn complex phenomena into easily understandable findings for the reader.

Service (n.): A commonly accepted term used to identify the time when food is being served to customers. Example: Foodservice employees will say "before service" to identify the time before customers are actually served.

Spatial layout and functionality (n.): For the purposes of this research, these two terms were reviewed as one factor. "Spatial layout refers to the ways in which machinery, equipment, and furnishings are arranged, the size and shape of those items, and the spatial relationships among them" (Bitner, 1992, p. 66) and "functionality refers to the ability of the same items to facilitate performance and the accomplishment of goals" (Bitner, 1992, p. 66). Example: The spatial layout of equipment within a full-service hotel kitchen and the functionality of the spaces are important because an employee's ability to complete a job successfully translates directly to the success of fulfilling the customers' needs and expectations.

Tacit knowledge (n.): Knowledge that is acquired through practice (Kacmar et al., 2006). Example: Tacit knowledge is not just knowing facts but understanding how the facts produce results (Grant, 1996).

Turnover (n.): The ratio of employees who have left an organization to the remaining employees at an organization in any given time period (Price, 1977). See also "employee turnover." Example: Turnover is a challenging topic to study because variables differ among organization, race, culture, age, and values.

Walks through (n.): The behavior of an employee passing through a kitchen zone without conducting any behaviors within the zone. Example: An employee enters from

the prep kitchen, walks through the banquet kitchen without touch anything, and exits to the dish pit. This whole behavior is considered a "walk through."

Working conditions (n.): The circumstances and characteristics of a job that positively or negatively affect an employee in the workplace, such as: wages, relationships with fellow employees, training offered by management, scheduling, uniform requirements, and the physical environment (Simons & Enz, 1995). Example: If an employee is working under bad working conditions, it is rather unlikely for her to maintain a high level of job satisfaction.

Search Techniques

The researcher began the search for literature using the university's library search engine, as well as Google Scholar. The key topic that was being researched was the physical environment of a commercial kitchen, with a focus on spatial layout and equipment and the efficiency of the interaction of employees with the physical space. Beginning the search with interior design resources, the researcher quickly shifted to hospitality literature because the gap in the interior design literature was too large for specifics to be uncovered. The available literature on the topic is greatly lacking, so the researcher had to broaden the search using the basic Google search engine to become informed about the attitudes of the foodservice industry in regard to the premise of productivity being affected by the physical environment. The researcher also read blogs and magazine articles to find evidence of this kind of research being conducted in the foodservice industry. Little was discovered. As will be explained in detail in later sections, the researcher worked for a full-service restaurant and knew that research had been conducted about the spatial layout and functionality of restaurant kitchens, but time and time again the literature searches returned void. The researcher reviewed literature from the fields of interior

design, hospitality, foodservice, and psychology in order to compile the following literature review. The researcher used published articles from peer-reviewed journals in all of the above fields. The researcher also conducted searches using the online university library catalog to find books that could add to the literature.

Another challenge was inconsistency in terminology and vocabulary. Because little published research exists on the topic area, the researcher had to get creative to uncover the literature sources and greatly broaden the scope of the literature review. Searches were run over and over using slight variations in the search terms, resulting in more useful resources. The following is a list of some of the words the researcher used in order to locate literature: kitchen efficiencies, workflow efficiencies, kitchen workflow, back of house workflow, foodservice, kitchen layout, restaurant layout, kitchen design, restaurant design, full-service restaurant, behavior mapping, behavioral mapping, workflow mapping, workflow maps, kitchen space planning, space planning efficiencies, spatial layout, working conditions, and environmental conditions. In following reference lists from discovered articles, the researcher encountered terminology discrepancies from article to article that made defining terms challenging.

The researcher bought an iPad in hopes of "saving the world" by not printing out all of the articles necessary to complete the review of literature. The researcher also purchased a PDF reader app for the iPad in order to keep all articles organized. This plan worked for a while as the researcher downloaded articles to a file-hosting service and then read, highlighted, and notated the articles using the PDF reader. Upon near completion of the literature review, the researcher found a great asset in printing the needed articles out and highlighting them by hand, organizing them by category in a three-ring binder. This system proved beneficial, as the amount of digital articles had reached an overwhelming amount and wading through them proved to be a

frustrating challenge. Using sticky notes, the researcher was able to note important connections and finalize the literature review. The following section is a summation of literature pulled from several fields in order to give common language to the benefits of researching spatial layout and functionality as having an impact on productivity in the foodservice industry.

Literature Review

The Employee Turnover Dilemma

It is no secret that employee turnover impacts the bottom line in all industries. No level of management, no matter the field of expertise, likes to lose employees. It requires work, effort, and time to find new staff, thus delaying the work process. The foodservice industry is no different. Although statistics about foodservice industry turnover differ across different sources, there is a commonality. The commonality is that employee turnover in the foodservice industry is problematically high. One source states that hourly and salaried management employee turnover rates are too high, and are on occasion doubled when compared with other retail sectors (Zuber, 2001). Another article states that full-service restaurants have a 50% annual employee turnover and fast food restaurants hit the 100% mark (Ghiselli, La Lopa, & Bai, 2001). In the literature, other terms are also used to describe turnover:

- Labor turnover (Rowley & Purcell, 2001; Ingram & Jones, 1998)
- Labour churn (Rowley & Purcell, 2001)
- Job turnover (Hom & Kinicki, 2001)
- Job mobility (Ingram & Jones, 1998)
- Employee turnover (Cotton & Tuttle, 1986)
- Worker turnover (Burgess, 1998)

The literature defines “turnover” as the ratio of employees who have left an organization to the

remaining employees at an organization in any given time period (Price, 1977). In this study, the researcher used the phrase "employee turnover" to indicate the process of employees leaving one organization for another organization or to move into a state of unemployment. In understanding why employee turnover is a major issue affecting the success of an organization, the researcher focused on two things to take into consideration:

- Explicit vs. tacit knowledge (Kacmar, et al., 2006)
- Efficiency gained through mastery (Hinkin & Tracey, 2000)

Hinkin and Tracey (2000) tell a story of three similar home improvement stores. There are few differences in these three stores other than how they handle and treat their employees and how the employees treat the customers. Two stores (A & B) focus on keeping labor costs low, while the third store (C) has a different strategy. Store C invests in its employees, allowing them to think creatively when handling customer situations, putting them through extensive training to learn about products and techniques, and paying them well above the rate the competition offers. Although store C has a high labor cost, it has a much lower employee turnover rate than stores A and B. These stores are virtually identical when it comes to location, products, and pricing. The difference is that store C places an emphasis on the way they manage their employees, with expectation that their employees will provide quality customer service. In short, store C ended up putting stores A and B out of business. Happy employees mean happy customers (Chi & Gursoy, 2009; Spinelli & Canavos, 2000). Employee turnover matters.

In the above example, store C realized the value of tacit knowledge, or knowledge that is learned only from involvement in different circumstances. The two types of knowledge found in the literature are explicit and tacit (Kacmar et al., 2006). Explicit knowledge is knowledge that is written down, often in the form of policies and training manuals (Kacmar et al., 2006). Store C

went to a deeper level of learning, beyond explicit knowledge, when it used extensive training to teach employees. Extensive training exposes employees to problems and solutions so that they can develop their tacit knowledge base. The definition of tacit knowledge is knowledge that is acquired through practice (Kacmar et al., 2006).

The more tacit knowledge an employee acquires, the closer they move from a competence level of employment to a mastery level (Hinkin & Tracey, 2000). Competence includes orientation, formal training, and on-the-job training, whereas mastery of a position includes handling exceptions to the rule and understanding the business's systems. Finally, the employee gains efficiency in their job position (Hinkin & Tracey, 2000). Although the costs of turnover have been outlined extensively in literature, "many managers do not understand the productivity increases that can be obtained by maintaining a stable workforce by providing employees with meaningful work and a pleasant workplace" (Hinkin & Tracey, 2000, p. 17). Although typically viewed as a cost of doing business, reasons of turnover can be explored in order to retain a workforce that is able to move into the mastery employee level (Hinkin & Tracey, 2000). At this level, employees have seen many circumstances and situations and have learned to handle them accordingly, whether leaning from a supervisor's involvement or from the old-fashioned trial and error technique. Employees that have been exposed to work-related problems and the solutions that accompany them have increased efficiency in dealing with these problems when they arise in the future. This increases the employee's ability to complete their job in a timely fashion, and the work process moves smoothly. When this occurs, time and opportunity open up for that employee to be responsible for more challenging situations, or more work tasks in general, increasing their productivity. Employee turnover negates the ideal of increasing employee efficiency (Kacmar et. al, 2006). Employee turnover costs the business money. The costs of

employee turnover include the time and money it takes to find, hire, and train a new employee (Zuber, 2011), but more importantly, employee turnover costs include the time and money wasted in potential efficiency from the old employee (Kacmar et. al, 2006). Employee turnover occurs for a variety of reasons. Prior to 1986, approximately 120 sets of data addressed the topic of employee turnover (Cotton & Tuttle, 1986). A meta-analytic study of the literature on employee turnover, prior to 1986, revealed 21 studies that examined the variable of overall job satisfaction in employee turnover (Cotton & Tuttle, 1986). This was the highest studied employee turnover variable, second only to pay (Cotton & Tuttle, 1986). Fifteen years after the meta-analytic study was published, job satisfaction is still believed to be one of the most important when understanding employee turnover (Ghiselli, La Lopa, & Bai, 2001). The next section defines job satisfaction and gives an overview of the factors that make someone unsatisfied in their job.

Job Satisfaction

The definition of job satisfaction is "the pleasurable emotional state resulting from the appraisal of one's job as achieving and facilitating the achievement of one's job values" (Locke, 1969, p. 316). An employee assesses their job on a scale of their personal values (Locke, 1969). This may explain why job satisfaction is a challenging concept to measure, because each employee has a separate set of values that impacts the feeling that "my job satisfies me." For example, consider the following three men who do the exact same job at a restaurant: one is a 55-year-old husband and father of three, another is an 18-year-old college student whose parents still pay his bills, and the last is a 30-year-old man whose second language is English and who sends the majority of every paycheck to his family in Guatemala. All three of these men do the exact same job every night; however, they each use a completely different set of values to

determine whether they are satisfied in their job. Although difficult to measure, research does exist to help quantify job satisfaction. In 1977, Quinn and Staines defined a list of factors that affect job satisfaction:

- Ability utilization
- Need for achievement
- Chance for advancement
- Company policies and practices
- Compensation
- Creativity
- Security
- Working conditions

All of these factors contribute to job satisfaction. As in the example of the three cooks above, employees may rank these factors of job satisfaction differently in importance, but they all play a role in their overall job satisfaction. In a matrix for analyzing turnover (Wasmuth & Davis, 1983), reproduced in Table 1 below, a reason for turnover is that an employee is dissatisfied with working conditions.

Table 1

Matrix for analyzing turnover, reproduced from Wasmuth & Davis (1983)

	Planned	Unplanned
Avoidable	(I) Dismissed	(II) Quit
Unavoidable	(III) Termination	(IV) Resignation

A dissatisfaction with working conditions is identified in class II of turnover, as seen in the

above matrix in the (II) Quit segment (Wasmuth & Davis, 1983). This class falls under the unplanned and avoidable segment of the matrix. It means that poor working conditions are an avoidable reason for an employee's dissatisfaction. This literature review will focus on the working conditions part of employee dissatisfaction because this is one area in which interior designers can readily contribute. In the next section, the term "working conditions" will be defined and explained.

Working Conditions

In a study of hotel employees from seven hotels, participants ranked a list of 10 work factors from 1-10 that they most wanted from their employers. These factors included things like good wages, working conditions, tactful discipline, opportunities for advancement, and appreciation for accomplishments (Simons & Enz, 1995). Interestingly, good working conditions was ranked 4th overall by all of the employees of the hotel. The study further reported the results by hotel department. Back of house and food and beverage (F&B) employees (which include cooks, chefs, and stewards) ranked good working conditions as the second highest thing they wanted from their employers. This means that back of house food and beverage employees prioritize good working conditions as second only to good wages as work factors they most desire from management (Simons & Enz, 1995). This research defined good working conditions as "a safe and clean work environment in which good relationships prevail" (Simons & Enz, 1995. p. 23), and the physical environment as well as relational environment combine to form the definition of working conditions.

In literature, the terms "working conditions" and "kitchen conditions" seem to be used to describe similar things. Young and Corsun (2010) use the heading "kitchen conditions" in their article to address conditions and hazards such as burns, strains and sprains, falls, etc. The

research conducted by Young and Corsun (2010) was a self-reported survey with 213 useable results of hourly paid cooks from 13 unionized hotels to discover their level of intent to leave their current employer. The researchers also use the term "working conditions," stating, "working conditions depend on the quantity, variety, and labor-intensiveness of menu items" (Young & Corsun, 2010, p. 84). If kitchen conditions are below par, there is the potential for workers to be distracted. Distracted employees can potentially ignore safety hazards and could cause or receive injury. Another hazard that could lead to employee negligence is "heightened anxiety or overstimulation" (p. 84). In this article, researchers discuss the physical environment and emotional environment in order to explain working conditions.

At an International Labour Conference in 1990, members from 72 countries and states discussed a topic titled "Working Conditions in Hotels, Restaurants, and Similar Establishments". The proposed conclusion included 38 recommendations with topics of remuneration [wages], hours of work, scheduling, and training. These are the characteristics that the International Labour Office and its participating members use to define working conditions. In the context of Wjobs in K-12 schools, "working conditions can be hazardous, with the risk of burns, cuts, falls, and similar mishaps. Moving and carrying heavy containers and/or equipment are often necessary, as is almost constant standing" (McCain, 2009). These described working conditions all relate to the physical environment.

From these literature sources it seems that the term "working conditions" is a large umbrella that includes the following factors:

- Wages
- Employee relationships
- Training

- Scheduling
- Uniform requirements
- Physical environment

For the purposes of this research, the researcher defined working conditions as the circumstances and characteristics of a job that positively or negatively affect an employee in the workplace, such as: wages, relationships with fellow employees, training offered by management, scheduling, uniform requirements, and the physical environment. This research will focus on the working condition of the physical environment and will go into detail on this topic in the following section.

Physical Environment

The literature prioritizes the physical environment component of working conditions over to other factors. For example, the following factors of working conditions have all been studied in the hospitality industry:

- Wages (Simons & Enz, 1995; Kovach, 1987; Stuman, 2001)
- Employee relationships (Amarjit 2008; Corsun & Enz, 1999; Dermody, 2002; Hancer & George, 2003; Willemyns, Gallois & Callan 2003)
- Training (Chiang, Back & Canter, 2005; Gonzalez & Garazo, 2006)
- Scheduling (Chiang, Birtch & Kwan 2010; Ernst, Jiang, Krishnomoorthy & Sier 2004)
- Uniforms (Nelson & Bowen, 2000).

Although some factors of the physical environment have been studied in the hospitality and food service industry, there is little published literature on the physical environment. The following examples are food service specific topics in which the physical environment has been studied:

- Ergonomics (Cocci, Namasivayam & Bordi, 2005; Pehkonen, Takala, Ketola, Viikari-

Juntura, Leino-Arjas, Virtanen, Haukka, Holtari-Leino, Nykyri, & Riihimaki, 2009)

- Hygiene (Chow, Alonso, Douglas & O'Neill, 2010; Sabbag & Hepsag, 2011)
- Injuries (Atkinson, 2002; Jones, Strickfaden & Kumar, 2005; Pehkonen, Ketola, Ranta, Takala, 2009; Smolander, 1999)
- Ventilation (Keil, Kassa, & Fent, 2004)

Bitner (1992) suggests that food service establishments and office spaces are both complex physical environments. In an office setting, the physical environment plays a role in the productivity level of an employee (Davis, 1984). A study of ergonomic prep tables, discussed in a later section, identifies that productivity can be affected by the physical environment in a food service setting (Cocci et al., 2005). From the literature review, the researcher has identified that the physical environment is an aspect of working conditions. A productive physical environment promotes good working conditions. Because working conditions are a component of employee job satisfaction (Quinn & Staines, 1977) and job satisfaction is the prominent cause of employee turnover (Ghiselli, La Lopa, & Bai, 2001), it is imperative that the physical environment is examined when searching for opportunities to reduce employee turnover. Psychologists did not start exploring the physical environment as a way to predict or explain behavior until the 1960s (Bitner, 1992). Contemporary researchers understand that human behavior is greatly impacted by the physical environment. One of the results of our current understanding of this human-environment relationship is the practice of evidence-based design.

Evidence-Based Design

Interior designers use the term "evidence-based design" to describe the process of using credible research to produce design solutions for the built environment (Levin, 2011). Published literature shows that evidence-based design can impact performance, productivity, consumer

spending, and workforce turnover, as will be demonstrated in the following sections. The following sections identify examples of studies, across a wide array of industries, where evidence-based design was used to generate solutions for problems concerning the spatial layout and functionality element of the physical environment.

Interior designers have actively used the principles of evidence-based design in the healthcare industry. Tanja-Dikstra (2011) discovered that removing medical equipment from the view of the patient reduced the feelings of stress the patient experienced during their hospital stay. Researchers identified a reduction in nosocomial infections in patients who stayed in isolated rooms and this reduction in infections led to a decreased length of stay (Ben-Abraham, Keller, Szold, Vardi, Weinberg, Barzilay, & Paret, 2002). Staff who used a healing garden within a hospital experienced decreased emotional distress when compared with employees who did not use the garden (Sherman, Varni, Ulrich, & Malcarne, 2005). Parents who stay overnight with their hospitalized child provided benefits in their child's recovery (Dudley & Carr, 2004). Subjects who stayed with their children requested certain furniture in the hospital room to make their stay comfortable (Dudley & Carr, 2004). For children in non-isolated rooms, parents suggested adding private areas where health care professionals and family members could discuss the child's diagnosis (Dudley & Carr, 2004). Patients who suffer from dementia and Alzheimer's have a symptom of wandering (Dickinson & McLain-Kark, 1996). Corridors and exiting systems can be designed to offer a safe way for these patients to wander without injuring themselves or exiting the facility (Dickinson & McLain-Kark, 1996). A review of literature was conducted to review research strategies, case studies and examples of design solutions involving wandering and were published in order to increase the body of knowledge of spatial layout and functionality in the field of healthcare design (Dickinson & McLain-Kark, 1996). All of the

above published works help future designers in their quest to provide optimal spaces for patients, families of the patients, and employees.

As in healthcare, design clients in education have witnessed success when evidence-based design has been implemented. In a project completed by NAC Architecture of Seattle, Washington, the physical environment affect on student performance was investigated when the firm was chosen to build the Wilson High School in Tacoma, Washington (Hamilton & Watkins, 2009). Using experience, review of published literature, and physical modeling, the architecture firm produced a building with documented results concluding that physical space has an impact on productivity and absenteeism of students (Hamilton & Watkins, 2009). The solutions for the project focused on day-lighting and indoor air quality after the firm discovered through documented literature that quiet and healthy environments are two contributing factors to student performance (Hamilton & Watkins, 2009). Although additional documentation of the results is necessary to realize the full impact on the student and faculty population, it is already documented that increased productivity and decreased absenteeism are two benefits of the efforts of NAC (Hamilton & Watkins, 2009).

In the same way student performance is important in an academic setting, worker performance is important in an office setting. Because the physical environment plays a role in worker performance and productivity, evidence-based design can improve both these constructs (Knoll, 2010). One of the many case studies conducted by Knoll, Inc. involved workstation inquiry and its impact on employee performance (Knoll, 2010). High panel heights cause physical and visual discomfort in conjunction with a Heating, Ventilation, and Air Conditioning (HVAC) system not prepared for high panels (Knoll, 2010). Another result is efficient interior workstation layout aids workers to do their best work (Knoll, 2010). The company has also

witnessed a decreased stress level for employees who have been given greater control of features in their workstation, such as their task chair and the height of the their keyboard (Knoll, 2010).

While worker productivity is a primary concern for office spaces, consumer-buying habits are the focus of retail spaces. The physical environment and evidence-based design can impact consumer spending (Meyers-Levy & Zhu, 2007). A study published in the *Journal of Consumer Research* tested the impact that ceiling heights have on customer mental processing (Meyers-Levy & Zhu, 2007). The researchers conducted three experiments using eight- and ten–foot-high ceilings. The customer's mental processing components of confinement and freedom were tested (Meyers-Levy & Zhu, 2007). The type of mental process that a consumer uses is important because it ultimately leads to how the consumer analyzes the retail items' attributes (Meyers-Levy & Zhu, 2007), ultimately determining whether or not the item is bought. By using evidence-based design and the results of this study, designers can aid their client's in influencing the buying habits of their consumers.

Interior Design in the Food Service Industry

Interior designers continue to develop a growing body of literature using evidence-based design that supports the statement "the physical environment affects human behavior." The abovementioned examples in healthcare, office space design, education, and retail identify where evidence-based design has been used to improve the spatial layout and functionality of a space. The food service industry has also identified benefits of studying the physical environment. A study from the food service industry focusing on spatial layout and functionality investigated the impact of ergonomic design on productivity improvements in food service production or worktables (Cocci et al., 2005). The researchers used an advanced undergraduate control group who chopped potato cubes on standard 34-inch-tall worktables. The experimental group chopped

potato cubes on worktables that were set per individual at a worktable height four inches below their elbow. Although after 40 minutes no statistical difference in self-reported pain between the groups was noted, the mean production between the groups was different. The sample group, using ergonomically suitable worktables, had a higher level of productivity than the group who used the standard worktable height (Cocci, et al., 2005). The physical environment affects human behavior. In this study the researchers tested a theory that production table height can impact productivity in a commercial kitchen. If something as simple as production tables that change height can impact productivity, the researcher proposes there are other things within a full-service hotel kitchen that can be explored within the category of spatial layout and functionality that could potentially increase employee productivity.

Bitner (1992) identifies spatial layout and functionality as an environmental dimension that affects human behavior. The three categories of environmental dimensions are as follows:

- Ambient conditions (e.g., temperature, air quality, noise, music, odor)
- Spatial layout and functionality (e.g., layout, equipment, furnishings)
- Signs, symbols & artifacts (e.g., signage, personal artifacts, style of decor)

It is important to acknowledge that even though these three dimensions are broken into categories, the employee responds to these dimensions in a holistic way (Bitner, 1992). Therefore it is important to investigate all three environmental dimensions when investigating how human behavior is affected. Although the environmental dimensions of ambient conditions and signs, symbols, and artifacts are important components of the physical environment's impact on human behavior, to narrow the scope of this study, the researcher will not be discussing them in this paper. However, any changes to the physical environment should take into account all three environmental dimensions.

As mentioned in the introduction, working conditions have been identified as one of the factors that affect employee job satisfaction (Quinn & Staines, 1977). The physical environment is one of these working conditions. Spatial layout and functionality has been identified in literature as a part of the environmental dimensions of a physical environment (Bitner, 1992). This literature review previously highlighted the negative implications of employee turnover on the food service industry. Little research has been published on the topic of spatial layout and functionality in the food service industry. In the following sections, the researcher identifies reasons for this lack of published research.

Space/Function

Environmental dimensions fall under three categories: ambient conditions, spatial layout and functionality (also called space/function), and signs, symbols and artifacts. This manuscript focused on spatial layout and functionality because there is little research published on spatial layout and functionality in the food service industry and further development of this area would benefit both interior designers and food service professionals when designing a physical environment that promotes employment retention. The environmental dimension of spatial layout and functionality can be defined as "the ways in which machinery, equipment, and furnishings are arranged, the size and shape of those items, and the spatial relationships among them" (Bitner, 1992, p. 66). Little has been published within the past 20 years on spatial layout and functionality in a food service kitchen. The lack of published research in this area may suggest one of three underlying problems:

- The dimension of spatial layout and functionality in the food service industry is not valued.
- The dimension of spatial layout and functionality in the food service industry is valued

but not studied.

- The dimension of spatial layout and functionality in the food service industry is valued and studied but not published.

Consider that the dimension of layout and functionality in the food service industry is not valued. Arthur C. Avery, a pioneer in food service layout and design, states “it behooves us in equipment and kitchen design and food service operations to recognize the environmental conditions under which man performs best and then provide what he needs to maximize his performance” (p.74). His article discusses the physical environment for the best human performance in a commercial kitchen. His topics include:

- Lighting
- Color
- Sound
- Odor
- Work area
- Height
- Aisles and other work areas
- Equipment
- Controls and displays
- Work-space relationships
- Transportation
- Motion and human engineering

Although all of the above factors are interesting when investigating human performance, this study focused on the factors of work area, aisles and other work areas, and workspace

relationships, as this is the area in which interior designers can most readily contribute. With regard to a cook's work area, it is feasible to provide a physical environment to do his job easily, in a habitual pattern, and with minimum physical and mental interference (Avery, 1965). Aisles can be too small or too large, and either can cause major problems in the kitchen (Avery, 1965). Laying out the physical environment to promote healthy workspace relationships can reduce the number of steps a cook takes, prevent dripping and greasiness on the floor, and allow the cook to fully engage in the present task (Avery, 1965). This article demonstrates that spatial layout and functionality has been valued in the food service industry for almost 50 years.

Consider next the possibility: that the dimension of spatial layout and functionality is valued but has not been studied. We know that this is also not true because ergonomics is the study of people's efficiency in their working environment (OSHA, 2000). In 1965, Avery makes a point that providing an ergonomically pleasing physical environment leads to a happy, uninjured cook. In the worktable study reviewed earlier in this manuscript, Cocci et al. (2005) suggest that an ergonomically pleasing physical environment leads to increased productivity. Spatial layout and functionality was also studied at East Tennessee State University. The researcher conducted a layout and operation study focused on the functions of batch cooking and dishwashing in the food service portion of campus called The Markey Place. The researchers identified problem areas and made suggestions on how to decrease bottlenecks in order to increase the productivity of the workflow process (Wang & Tian, n.d.). These two studies show that the environmental dimensions of spatial layout and functionality are valued and studied in the food service industry.

Finally consider the dimension of spatial layout and functionality is valued and studied but not often published. The researcher has worked in the food service industry for eight years in a

variety of positions. The researcher worked at two restaurants owned by a large chain restaurant company. As a trainer for new employees and an administrative assistant to the managing proprietor, the researcher was exposed to internal company documents. These documents include company-specific studies that involve increasing productivity by improving spatial layout and functionality of the cook line. One example of these documents is a pamphlet for kitchen managers that included detailed descriptions of how to set up the sauté station (kitchen subsection) on the cook line (kitchen zone). The details included the tools necessary to complete the job and instructions on where to place prep items in the station and on how each food item cooked in this area was to be completed.

The researcher was exposed to another example of spatial layout and functionality research from a different company. The researcher was shown a social networking group where members included management teams from many separate stores within the chain. On this forum, members of management would post problems they were experiencing in their store and receive feedback from other members who may have had similar problems and the solutions that were developed. Also posted in this forum were studies conducted by individual stores in order to improve the efficiency and productivity of their kitchens.

Although made aware of these studies, the researcher could not use any of the results in this manuscript because of proprietary concerns. Although these studies are proprietary and the findings cannot be shared with the public, the researcher can make the statement as an expert in this area that such studies are used internally to improve spatial layout and functionality of the company's restaurant kitchens. Literature does exist on the dimension of spatial layout and functionality in the food service industry, but there is very little peer-reviewed literature available on this specific topic.

In this manuscript, the researcher proposes a method to produce literature in the area of spatial layout and functionality of a full-service hotel kitchen. The method proposed employs the research tool of behavior mapping, used by interior design and other researchers. The following section will define behavior mapping and give examples of how the tool has been successfully used in interior design research.

Behavior Mapping

Behavior mapping is an objective method used to investigate the physical attributes of the built environment in association with observed behaviors (Cosco et al., 2010). The terms behavior mapping (Schwarz, Chaudhury, & Tofle, 2004; Cosco et al., 2010) and behavioral mapping (Miller & Keith, 1973; Pugsley & Haynes, 2002; Waxman, 2006) are used in the literature to define seemingly the same concept. Because a definition for behavior mapping was clear in the literature, the researcher will be using the term "behavior mapping" throughout this work. Informedesign.com, a reputable interior design resource, uses the terms behavioral mapping and behavior mapping interchangeably on the Web site. The organization identifies the two types of behavioral mapping: person-centered and place-centered (Guerin & Dohr, n.d.). The researcher chose to use place-centered mapping for this study because the focus was on the places in which behaviors occurred, instead of the person conducting the behaviors. Place-centered behavior maps are used to identify how individuals use a space. "Observers watch the actions in a particular behavior setting and record them on diagrams or plans" (Guerin & Dohr, p. 4). The seamless integration of human inhabitants with the physical environment produces a productive space (Leaman, 1995), and behavior mapping is a tool that identifies the ways people interact with the physical space. Examples listed below are studies conducted using the tool of behavior mapping.

A research study of an office space used the tools of questionnaires and behavior maps to investigate satisfaction with the design features of a newly renovated office building (Pugsley & Haynes, 2002). Questionnaires were distributed after the office space had been occupied three months and observations were conducted after three, six, and twelve months of occupation. The researchers compared the results of the questionnaire with the results of the observations. Observations revealed different areas of the office in which resources were underutilized, and the cost of the improvement did not seemed justified by the lack of use.

Behavior mapping was used during the renovation process of a long-term dementia care facility (Schwarz et al., 2004). Researchers conducted place-centered behavior mapping in randomly assigned half-hour periods of time. The researchers observed public places throughout the facility and noted the number and type of users that were present, as well as the activity patterns that the users displayed. Behavior mapping was conducted before, immediately after, and three months after the renovation of the facility.

In a study of coffee shop behavior, behavioral mapping was used in combination with survey and interview tools (Waxman, 2006). The researcher used a copy of the floor plan of the coffee shop to note when seats were occupied. Detailed field notes were taken of the behaviors conducted by coffee shop customers. The researcher used a letter system to identify certain customers in the space that allowed the researcher to analyze the data at a later date (Waxman, 2006). Cosco et al. (2010) used behavior mapping as an objective method of evaluating behavior linked to the physical characteristics of outdoor areas. In this study, the researchers observed preschool children at childcare centers and used behavior maps to pinpoint where certain activities occurred. Researchers documented the different behaviors that occurred in different settings: pathways, play equipment, sand play, and open areas. The researchers concluded that

behavior mapping, in conjunction with previously used methods, is an encouraging method for accurately linking environmental components to the actions of children.

In 1973, a graduate student from a social-environmental psychology program conducted a behavioral mapping study (Miller & Keith, 1973). In this article, the method was called behavioral mapping. In this study, the researcher obtained an architectural plan of a hospital and divided the facility into five areas to which patients had access. During these observations, the researcher walked through the hospital, noting places where patients congregated and the behaviors occurring in each area (Miller & Keith, 1973). In order to determine where children played in their neighborhoods, researchers **[missing text]** (Veitch, Salmon, & Ball, 2008). In Australia, researchers gave a group of children between eight and twelve years old a map of their neighborhood, along with markers and instructed them to place different color Xs in areas such as where the child's home is located, where the children played in the last week, the locations most frequented by the children, and the locations where they play without adult supervision. The collected data was used to determine the level of access these children had to areas in which to engage in physical activity outside of their home or school. The self-reported behavioral mapping was a successful way to identify locations where the children were physically active.

In the present study, the researcher used a combination of behavior mapping conducted by the researcher and self-reported behavior mapping conducted by the employees. This self-reported behavior mapping was modeled after the above-mentioned study (Vietrich, Salmon & Ball, 2008) and the Gentry method. In Gentry's study (2010), the researcher explored routes taken by airline passengers through an airport. The passengers completed three cognitive maps of their behaviors through the Des Moines International Airport. The cognitive maps were collected two weeks prior to departure, the day of departure, and two weeks after the departure. These

maps were laid over one another and compared. In Gentry's study, expectations of a traveler's journey through the airport before the day of departure were compared with the actual route taken as the traveler journeyed through the airport. The self-reported part of the present study has employees document their journey around the kitchen on a person-centered behavior map, whereas the information gathered from the researcher's observations is gathered using place-centered behavior maps. Both the self-reported person-centered maps and the researcher-completed place-centered maps were compared, and conclusions about problems within the physical environment were pulled from these comparisons.

Behavior mapping has been used across several industries in an attempt to explain and articulate reasons for certain behaviors to occur within a space. Behavior mapping identifies which behaviors are being observed, and as patterns begin to emerge, the researcher is able to identify the "why" of some of the behaviors. Observations provide an in-depth look into how people interact with the space around them. Using behavior mapping as a tool, the components of spatial layout and functionality can be published in a way that promotes communication between professional barriers.

Observable Factors

During observations in this study, the researcher focused on three main productivity inhibitors identified by the literature as factors that affect low productivity in the food service industry. Kahrl (1975) identified these inhibitors as follows:

- Excessive walking
- Product rehandling
- Cross traffic/confusion

The researcher used these productivity hindrances as variables in this study when

identifying problems with the spatial layout and functionality of the kitchen. Excessive walking is defined as an inhibitor of productivity in which the employee walks more than necessary to complete a task efficiently (Kahrl, 1975). An employee that walks excessively is wasting time and energy because that employee is producing only when they are standing and using their hands (Kahrl, 1975). The average food service industry employee spends a quarter of their time on the clock walking (Kahrl, 1975). This means that 25% of the time an employee is at work in the food service industry, they are wasting time and energy while not standing and using their hands.

Product rehandling is defined as an inhibitor of productivity in which an employee touches food, supplies, and dishes more than once (Kahrl, 1975). The less times food, supplies and dishes are handled and the less distance between them, the more productive the food service industry will be (Kahrl, 1975). Time and energy spent moving food, supplies, and dishes more than once is time that the employee is not standing and using their hands productively.

Cross traffic/confusion is defined as an inhibitor of productivity in which employees bump into each other or are forced to wait while an employee crosses their path of travel (Kahrl, 1975). The shortest distance between two points is in a straight line, and so alleviating the times employees must cross straight paths increases employees' productivity (Kahrl, 1975). The researcher proposes that confusion could be a product of excessive walking because walking gives employees time for their minds to wander and can lead to employees forgetting what they were in the process of doing. Bumping into other employees also causes confusion among employees because their mind is focused on the behavior of colliding with another employee. Excessive walking, product rehandling, and cross traffic/confusion are all hindrances of productivity because they demonstrate an inefficient use of a food service company's most

valuable resource (Tangen, 2002): its employees.

Conclusion

In the literature review, the researcher has demonstrated that the components of spatial layout and functionality are valued and studied in the food service industry. However, published research is limited and studies that do exist have not been peer-reviewed to determine validity of their methods. The researcher proposes that the food service industry could benefit from the expertise of interior designers who understand the theory and methods to best measure environmental dimensions, primarily spatial layout and functionality. Behavior mapping is an example of a tool known by interior designers that can be used to measure spatial layout and functionality. By using behavior mapping, researchers can identify productivity hindrances that affect the physical environment in terms of spatial layout and functionality. Once these productivity hindrances are identified, there is potential for improving employee job satisfaction by providing the employees with better working conditions through a more productive physical environment.

Methodology

Purpose

The purpose of this study is to aid interior designers and food service professionals by adding to the body of knowledge in spatial layout and functionality. The further purpose is to test a research tool that can be used to establish a benchmark for observing and identifying key productivity hindrances of the physical environment in terms of spatial layout and functionality in the foodservice industry. These hindrances are drawn from the literature and will be used as variables during this study:

- Excessive walking

- Product rehandling
- Cross traffic/confusion (Kahrl, 1975).

Justification

The researcher proposes the interior design industry can make use of the tool of behavior mapping when collaborating with the foodservice industry. This tool may be used to aid professional practice by identifying the hindrances of excessive walking, product rehandling, and cross traffic/confusion in the pre-design or post-occupancy stage. It may also be used as part of an evidence-based design process that results in published research in the topic area of spatial layout and functionality and its impact on productivity. Further, using a combination of discovered solutions in published literature and the tool of behavior mapping, upper management may be better able to retain employees by improving the physical environment aspect of working conditions.

Although all commercial kitchens are different in their needs and their layout solutions (Bitner, 1992), there are some common patterns (Kazarian, 1975). It can be inferred that studying one specific kitchen layout and the interactions of employees with the physical environment may aid in the design of other kitchens. In his book titled *Benchmarking,* Spendolini (1992) discusses how benchmarking can lead to future success of an organization. Even benchmarking information shared between competitors, when done honestly and professionally, can impact the organization in a positive way by exposing both organizations to new and different ways of doing things (Spendolini, 1992). For example, benchmarking information can aid the design and layout of a cook line in a full-service hotel kitchen. The following section describes the research questions that were used in this study to test the research tool that could potentially be used to establish benchmarks for organizations to explore the spatial layout and functionality of a full-

service hotel kitchen.

Research Questions

The researcher seeks to answer the following research questions with this method.

RQ1: Can the productivity hindrance of excessive walking (Kahrl, 1975) be observed through:

(A): researcher-conducted behavior mapping in a full-service hotel kitchen?

(B): employee completed paper-based survey in a full-service hotel kitchen?

RQ2: Can the productivity hindrance of product rehandling (Kahrl, 1975) be observed through:

(A): researcher-conducted behavior mapping in a full-service hotel kitchen?

(B): employee completed paper-based survey in a full-service hotel kitchen?

RQ3: Can the productivity hindrance of cross traffic/confusion (Kahrl, 1975) be observed through:

(A): researcher-conducted behavior mapping in a full-service hotel kitchen?

(B): employee completed paper-based survey in a full-service hotel kitchen?

RQ4: Does a paper-based survey combined with a behavior mapping method result in more descriptive behavior findings than survey method alone?

Answers to these questions will give the researcher insight into whether or not the researcher-conducted behavior mapping identified more productivity hindrances than the paper-based survey alone. These insights will also add to the published literature on spatial layout and functionality in a full-service hotel kitchen. The following section gives an overview of the method used.

Overview of the Method

The researcher conducted a method study using four of the six steps in the method study process defined by Slack, Chambers, and Johnson (2007):

1. Select the work to be studied
2. Record the present method
3. Examine the facts
4. Develop a new method
5. Install the new method
6. Regularly maintain the new method

For the purposes of this research and to reduce confusion on use of the term "method," the researcher used a modified version of the above method study, changing the word "method" to "process."

1. Select the work to be studied
2. Record the present process
3. Examine the facts
4. Develop a new process
5. Install the new process
6. Regularly maintain the new process

Owing to time and financial restraints, the researcher was only able to conduct steps one through four of the method study. Although results were presented to management, the decision to execute changes is in the hands of the management team of the full-service hotel kitchen. The execution of changes, as described in steps five and six, is therefore beyond the scope of this study.

Steps of the Method

The following explanation of the study's method was organized according to steps one through four of the method study defined by Slack et al. (2007): 1) select the work to be studied, 2) record the present process, 3) examine the facts, and 4) develop a new process. The researcher began with step one, selecting the work to be studied.

Step 1: Select the work to be studied. When deciding upon a location for the study, the researcher considered the type of commercial kitchen to be studied. The International Code Council (ICC), which produces the International Building Code (IBC), classifies a commercial kitchen as an assembly intended for food and/or drink consumption including, but not limited to: banquet halls, dance halls, night clubs, restaurants, taverns, and bars (IBC, 2012, Section 303.3). Some specific types of restaurants include: cafeterias, coffee shops or snack bars, and service restaurants (Kotschevar, 1961). When deciding on what type of commercial kitchen the study would be conducted in, the researcher used personal experience, expert opinion, and Kotschevar's (1961) model for choosing a foodservice facility:

1. "The food and service requirements of the group to be served" (Kotschevar, 1961): the researcher considered the demographic of the target audience who would have an interest in the research.
2. "The funds that will be available to meet expenses" (Kotschevar, 1961): the researcher considered the financial and time restraints on a graduate student.
3. "The system of operation chosen": the researcher considered the range of kitchen functions found in each type of commercial kitchen and established that a full-service hotel kitchen would have the largest array of functions, including preparation areas and numerous cooking functions for different types of service.

First, the researcher determined that travel time from home to the location should be minimized to save time and cost. The researcher narrowed the pool of prospective locations to those within the location of the researcher's university. Second, the researcher required a location that was unfamiliar to the researcher to avoid unnecessary bias. The researcher is a current employee of a full-service restaurant and was unable to use this place of employment as a location for the study because of the chance of familiarity affecting the integrity of the objective observations. Third, the kitchen must be large enough for the observer to remain outside of the work areas to be observed. The researcher eliminated options at which the kitchen was too small for observations to be completed. Last, the management team and employees must be willing to participate in the study. Using these criteria, the researcher was able to find a full-service hotel kitchen suitable for the study.

Communicate with management and staff. The first contact made with management was an email sent to the general manager of the hotel. The general manager set up a lunch meeting with the researcher in which the researcher's future plans were discussed. This meeting was preliminary, expressing the researcher's general interest in this topic. The general manager expressed interest in this study and offered the researcher full access to the hotel kitchen for the study. The researcher was told to notify the general manager when more specifics were to be arranged. After a year of preparation, literature, and method development, the researcher notified the general manager that the study was ready to conduct. Over the course of the preparation year, the researcher maintained e-mail contact with the general manager in order to stay on the hotel's radar. One of these emails included a request for access to the kitchen while employees were not present. The general managed forwarded the email to the executive assistant manager and executive chef, as well as both executive sous chefs. The researcher was asked to copy the entire

management team on every email following. The researcher was given access to the kitchen on April 16, 2013, at 4:00 am. The researcher was able to take photos of the entire kitchen without employees present. This gave the researcher a chance to become familiar with the kitchen. Selected images are shown below in figures 1 through 6.

Figure 1: Photo of restaurant kitchen expo line

Figure 2: Photo of double cook line in restaurant kitchen

Figure 3: Photo of banquet kitchen

Figure 4: Photo of bakery

Figure 5: Photo of dish pit

Figure 6: Photo of prep kitchen

The researcher set up a meeting with the management team for May 15, 2013, in order to go over the study, find out details, and answer any questions the management team may have had. Just one member of the team, one of the executive sous chefs, attended the meeting. At this

meeting with the executive sous chef, the researcher handed out a printed outline to make sure all points the researcher needed to address were discussed (see Appendix K). During this meeting, the researcher could sense that the chef was in a hurry, therefore the researcher gave a brief overview of the process and asked the chef several pertinent questions. The researcher was unable to ask the planned questions in the order anticipated but took extensive notes in order to fill in the blanks after the meeting. During this meeting, the chef told the researcher what attire was required in the kitchen. The uniform included black pants, a white chef coat, and a hat or hairnet, as well as non-slip black shoes. The researcher discussed areas to stand during observations, and the chef identified areas for the researcher to stand while conducting observations. The researcher was given permission to come in and out to conduct observations. The researcher was instructed that their presence would be assumed in the kitchen over the course of the observations and that there was no need to notify management when arriving or departing. The researcher had prepared a schedule for when observations were to be conducted, but upon meeting with the executive chef the researcher learned that a schedule would not be necessary. The researcher was told that the best times to come in for observations would be the times when the hotel was the busiest. The busier the hotel kitchen, the more activity there would be to observe and record.

The researcher discovered in this meeting that the chefs held monthly departmental meetings and that one was scheduled for two weeks later. The researcher asked the chef for a few minutes at the beginning of the departmental meeting in order to allow the staff to be introduced to the researcher and give the researcher a chance to explain the study, as well as time for answering any questions the employee's might have for the researcher. The chef stated that the researcher would be contacted about the meeting, but the researcher never was. The researcher

sent a reminder email to the chef in order to find out the details about the meeting. The researcher attended the departmental meeting and was able to answer questions about the study process and what was going to occur. The first meeting the researcher attended was on Friday May 24, 2013, at 3:00 pm and was attended by approximately fifteen employees. These employees consisted of the restaurant staff that had the responsibility of producing breakfast, lunch, and dinner service for the hotel restaurant. The second meeting was held on Saturday, May 25, 2013, at 2:00 pm and was attended by approximately six employees. These employees comprised the hotel banquet staff that was responsible for food preparations conducted in the conference rooms of the hotel. The presentation by the researcher lasted about three minutes for each meeting. The researcher gave a brief overview of the study and discussed the observation process as well as the self-reported survey process. The employees were told that their participation was entirely optional and their participation or lack of participation would in no way affect their employment status. All employees were notified of the financial incentive given by the researcher to complete the survey packet.

Producing the kitchen plan. The researcher was given the printed floor plans of the kitchen by the general manager. The researcher printed copies of the floor and equipment plans before returning the plans to the manager. Using these plans, as well as the photographs taken when no employees were present, the researcher pieced together a rough map of the kitchen (see Appendix A) using Adobe Photoshop software. The drawing was then recreated in AutoCAD in order for the researcher to have the ability to manipulate the drawing (see Appendix B). The researcher then subdivided the kitchen into smaller areas to create more manageable areas for observations to be recorded. Figure 7, below, is one example of the divided kitchen plans. This figure is the plan used for the restaurant kitchen observations. See Appendices C-G for the entire

collection of area plans.

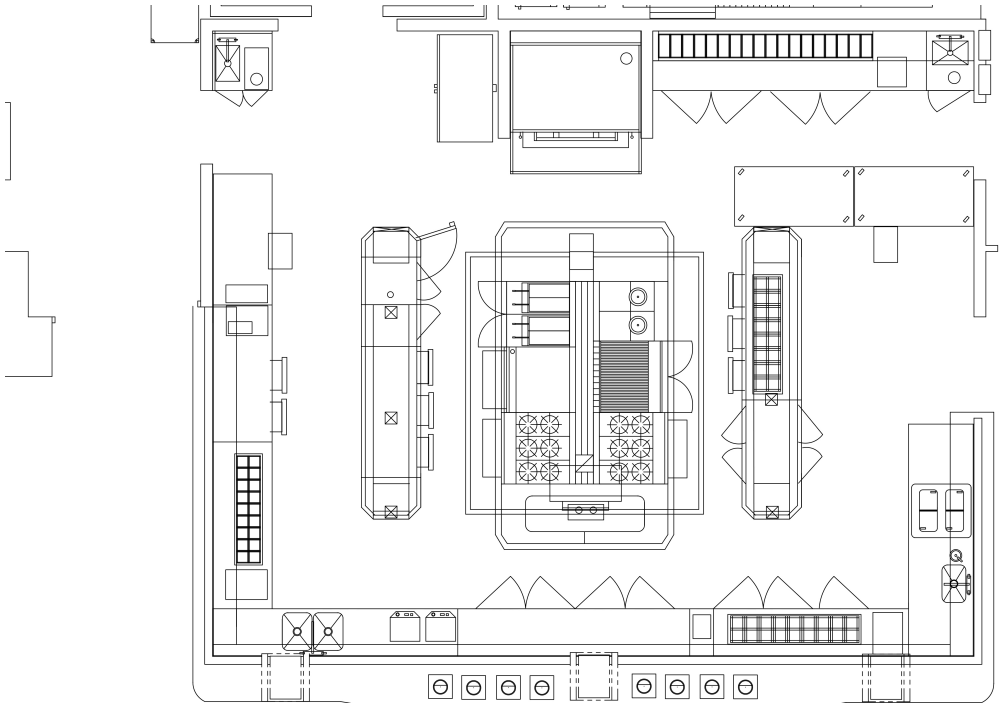


Figure 7: Example of the subdivided kitchen map, restaurant kitchen

Producing the observation method. Observations are best taken when the group being observed feels non-threatened and is told that the observer's observations are strictly objective (Heyns & Zander, 1953). The researcher appeared as nonthreatening as possible, being sure to stay out of the employee work area and freely answering any questions anyone might have had (Heyns & Zander, 1953). During the study, the researcher was an identified naturalistic observer. Naturalistic observation is defined as "a study method that involves covertly or overtly watching subjects' behaviors in their natural environment, without intervention" (Fournier, 2010, para. 1). Because the researcher was identified and openly observable by the employees, the researcher used the overtly naturalistic observation method and for the purposes of the study was called an identified naturalistic observer. Although interaction did occur, the researcher took careful precautions to avoid conversation and communication that revealed the researcher's attitude

about the behaviors that were occurring (Heyns & Zander, 1953) in an attempt to stay as objective as possible.

In order to record the behaviors that create a workflow within the kitchen function, the researcher spent 60 hours observing the interactions of employees with the space. Upon chef recommendations, the 60 hours were divided up by the amount of activity conducted in the space. The times were chosen based on what was occurring in the space at the time. The researcher completed 60 hours of behavior mapping over the course of an eleven-day period from June 10-20, 2013. Table 2, on the succeeding page, shows the times of observations. Different colors represent different areas of the space, as shown in the key.

Table 2

Times of observations, color-coded by location of observation

TIME 6/10/13-6/20/13	MON 6/10	TUES 6/11	WED 6/12	THUR 6/13	FRI 6/14	SAT 6/15	SUN 6/16	MON 6/17	TUES 6/18	WED 6/19	THUR 6/20	
6-7am								6:24		6:05		
7-8am	7:00-8:01		7:15	7:02								
8-9am		7:54			8:20				8:05		8:48	
9-10am							9:00	-9:20		-9:05		
10-11am		-10:24	-10:15	-10:02	-10:19						-11:48	
11am-12pm	11:00						-12:00	11:00		11:48		
12-1pm	-1:00	12:20	12:28	12:01								
1-2pm		-1:50		-1:59				-2:00	-2:02	-2:49		
2-3pm			-2:54									
3-4pm							4:20				4:36	
4-5pm												
5-6pm	5:35	5:33	5:31						6:00			
6-7pm							-7:22				-7:36	
7-8pm			-8:04						-8:01			
8-9pm	-8:35	-8:33										
TOTAL HRS	6 hrs	7 hrs	8 hrs	5 hrs	2 hrs		6 hrs	6 hrs	8 hrs	6 hrs	6 hrs	60 hrs

COLOR	SPACE
	Banquet Kitchen
	Bakery
	Restaurant Kitchen
	Dish Pit
	Prep Kitchen

Figure 8, below, shows the kitchen as a whole. The kitchen was too large to be observed as a whole, so the researcher used individualized area plans while conducting observations (Appendices C-G).

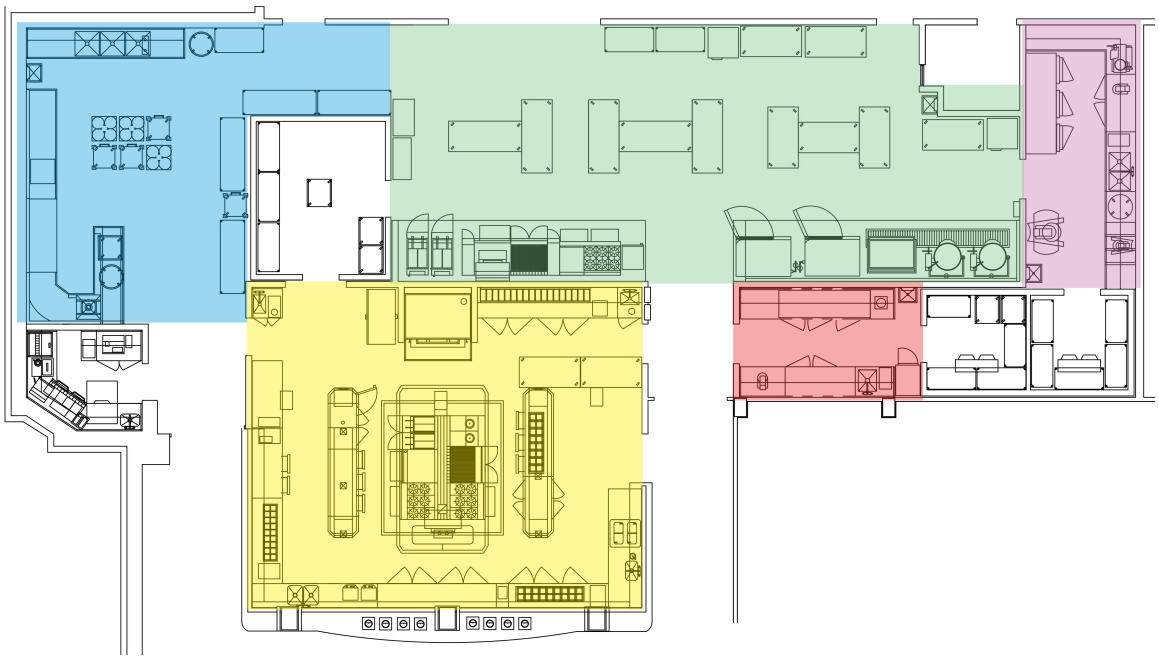


Figure 8: Kitchen as a whole, divided by color blocks

During the observation periods, the researcher held a clipboard with multiple blank plans for the area that was being observed and a number of colored pens. During certain observation periods, each color was assigned to a specific employee, known only by the researcher. To maintain confidentiality, the researcher used different colors for different employees during different observation periods. This means that a certain employee was not one color throughout the entire eleven-day observation period. Thus, at the completion of the study, no employee can be identified by the color used during observations in the recorded data. Although having no importance at the close of the study, the color-coded employee system was valuable during observations because the researcher found it was difficult to keep track of each employee's behaviors if only one color ink pen was used. For example, during the first observation hour, the researcher brought only a black pen. There were three employees present during the first hour of observation; therefore, deciphering the behavior paths of the employee with the single color of ink was nearly impossible. Using multiple colored inks allowed the researcher to distinguish

between employees' overlapping notes; some of the kitchen plan areas contained observations of up to eight employees working in one space.

Over the 60-hour period, the researcher observed a total of 43 employees and attempted to record as many behaviors as possible in order to analyze the data at the completion of the study. Examples of some of these behaviors include: stir pot, hesitate, walk through, unload box, sharpen knife, carry pot, fill pot with water, and talk to fellow employee. The researcher created a personal shorthand system for recording behaviors. Appendices P-DD includes some examples of the researcher's behavior maps. These observed behaviors were then compared with self-reported behaviors from the paper-based survey, as will be described in detail in the following section.

Producing the paper-based survey. The paper-based survey was developed in collaboration with two interior design professionals and two foodservice industry professionals, including a staff member at the hotel kitchen where observations were conducted. The survey was designed to be as brief as possible in order to encourage a higher response rate from employees. The survey consisted of eight questions developed using expert knowledge of questions that may be asked by management in an attempt to correct physical layout and functionality issues in a commercial kitchen. Two items were designed solely for demographic purposes:

- What is your job title?
- How many years have you worked for [restaurant's name]?

Two items were closed-ended questions designed to be answered using a five-point scale:

- How do you feel about the equipment and tools available to you in the kitchen in terms of being able to complete your job successfully? Choices for answering this

question ranged from very difficult (1) and very successfully (5).

- To what degree is the amount of space in which you work helpful in doing your best work? This question's answers ranged from very unhelpful (1) to very helpful (5).

One item was closed-ended questions designed to be answered using a four-point scale:

- If these changes were made, do you feel that you would be a more satisfied employee? This question's answers ranged from no change to my satisfaction (1) to great improvement to my satisfaction (4).

Three items were open-ended questions and were exploratory in nature:

- What tools, or equipment, if any, are missing in order to complete your job successfully?
- Are there any changes to the physical environment that you wish you could make in order to do your job more effectively?
- What other comments would you like to make about the layout of your workspace in the kitchen, or the kitchen as a whole?

Following each observation session, the researcher distributed survey packets to the employees who had been observed via a centralized drop-off location. Survey packets included a survey and plan of the entire kitchen (see Appendix I). The kitchen plan was a part of the survey packet modeled after the Gentry (2010) method in which participants self-reported their behavior in traveling through an airport during three different phases of their travel itinerary. The three self-reported behavior maps were compared to identify discrepancies between what the travelers thought their behaviors would be and what their actual behaviors were on the day of travel. The researcher used this as a model to determine the method of comparing the researcher's behavior maps with the self-reported employee behavior maps completed in the survey packet.

Step 2: Record the present process. Step two of the method study is recording the present process. It is important to distinguish the different functions of the kitchen in order to determine the physical requirements for the space (Kazarian, 1975). The typical functions are shown in Figure 9, based on Kazarian (1975, p. 74).

Figure 9: Typical kitchen functions, based on Kazarian (1975, p. 74)

One way to determine the functions of the kitchen is to study workflow patterns in existing kitchens. Workflow patterns include a stream of behaviors conducted by the employee. Each kitchen function has a wide range of behaviors that occur within the function. For example, if an employee is participating under the umbrella of the baking function, the employee's behaviors can include mixing ingredients, wrapping ingredients, cutting fruit, measuring ingredients, and slicing finished pastries. The baking function includes any behaviors that the employee conducts while in the process of baking. By studying workflow patterns, interior designers are able to identify the behaviors occurring within each function of the kitchen. Using principles of

workflow, a foodservice designer can then create a productive space in which people within the space act efficiently (Mill, 1989). The researcher used two research tools, behavior mapping, both researcher-conducted and self-reported, and a paper-based survey in order to complete step two of the method study.

Factors and variables. As stated in the literature review, previous studies have explored the variables of light (Wild, 1989, p. 231; Slack et al., 2007), temperature, and height of work surface (Cocci et al., 2005) and their effects on productivity in a commercial kitchen. The researcher will be exploring the human variable, emphasizing the employees' behavioral influences on productivity.

Kahrl (1975) stated that very low productivity in the foodservice industry is caused by three main reasons:

1. Excessive walking
2. Product rehandling
3. Cross traffic/confusion

The researcher used these productivity hindrances as variables in this study. Owing to the qualitative character of this research, the variables were exploratory in nature. The researcher acknowledges there are quantitative ways to measure the above variables. Excessive walking can be measured with a pedometer, which would count the number of steps the employee takes, but would not account for why the employee is taking the number of steps. In product rehandling, radio frequency identification tags (RFIDs) could be used to alert the researcher to how many times an employee comes in contact with a specific product. But the radio frequency identification does not explain why the employee touched the product more than once. There are plenty of ways to measure these three factors quantitatively with numerical data, but a qualitative

case study allows the researcher to explore the how and the why of certain behaviors occurring, not just the acknowledgment that the behaviors are occurring (Baxter & Jack, 2008). Behavior mapping gave the researcher the ability to draw conclusions about multiple variables simultaneously (Cosco et al., 2010).

Execution of behavior mapping. Behavior mapping is a method used to investigate the physical attributes of the built environment in association with observed behaviors (Cosco et al., 2010). Behavior mapping has been used as a tool to:

- Investigate the activities of dementia patients within a space (Milke, Beck, Danes, & Leask, 2009; Smith, Matthews, & Gresham, 2010)
- Link preschool activity with outdoor playground design (Cosco et al., 2010)
- Study staff needs in an office space work environment (Pugsley & Haynes, 2002)
- Explore the characteristics of gathering behavior and place attachment of patrons in coffee shops (Waxman, 2006)

Behavior mapping led the researcher to connections between the variables of excessive walking, product rehandling, and cross traffic/confusion that established a more holistic view for the researcher. The interrelationships between the three factors discovered by the researcher uncovered new insights that would otherwise have not surfaced from quantifiable methods. The researcher recorded observations on kitchen plans. Figure 10, below, shows an example of a plan used to record observations.

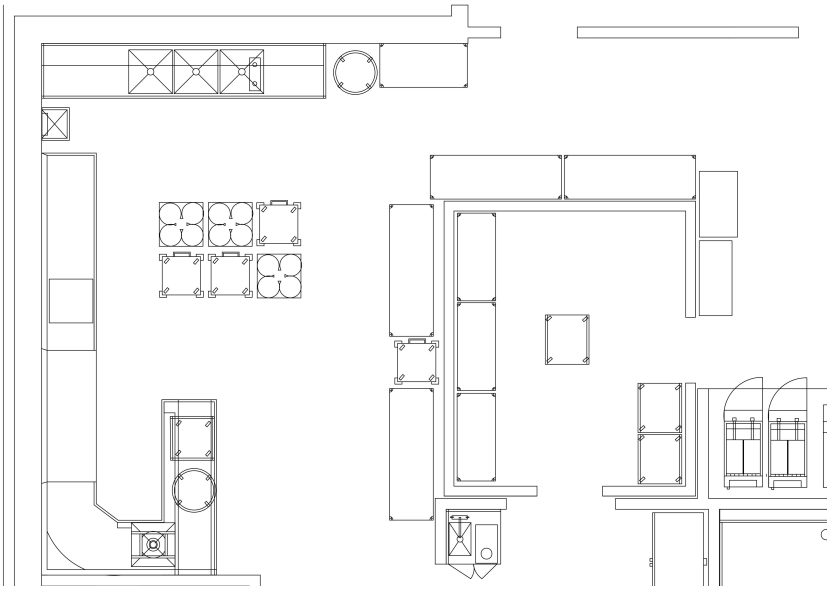


Figure 10: Example of a blank plan used to record observations

Execution of paper-based survey. Following each observation session, the researcher distributed survey packets to the employees who had been observed via a centralized drop-off location. Survey packets included a survey and plan of the entire kitchen (see Appendix I). On the front of the packet the researcher wrote in the date and time of the observation (see Appendix H for the packet cover page). Names of the employees were written on sticky notes that were placed on the uncompleted packets and coordinated with the ink color of the employee for the specific date and time observed. Labeled packets were then placed in a hanging file folder outside of the chef's office in the back of the kitchen. The employee removed the sticky note after the blank survey packet was picked up. When the employee returned the completed packet, the color at the top labeling the specific time and date observed was the only identifying mark that coordinated the survey with the researcher's behavior maps. Figure 11 contains an arrow that identifies the placement of the file folder box on the wall outside of the chef's office.

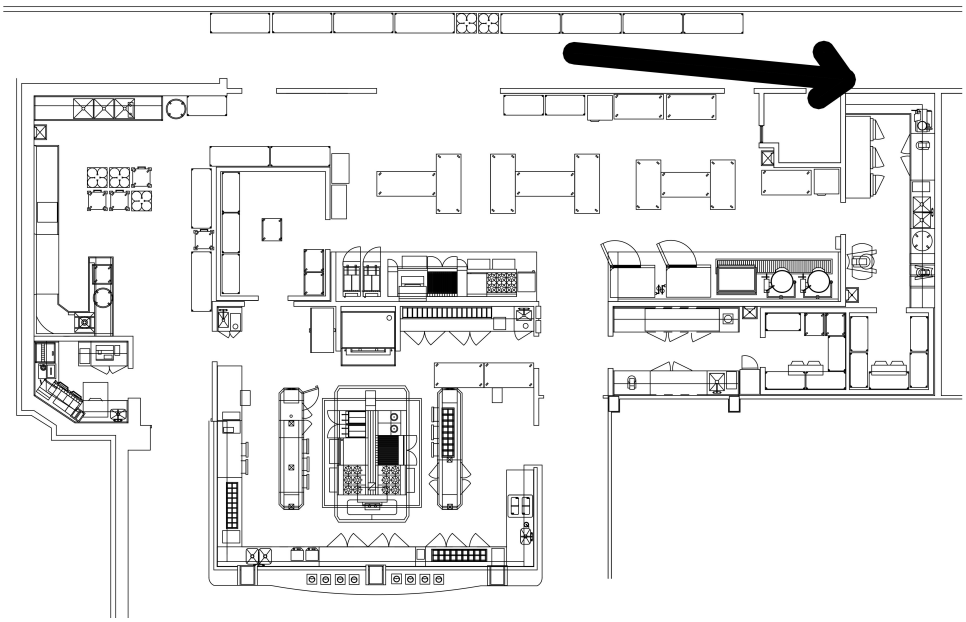


Figure 11: Placement of the file folder box containing employee survey packets

Employees were instructed to check the box periodically to see if they had a packet to fill out and were asked to return the packet to the file folder box after completion and remove the sticky note that labeled the packet with the employees' name. Upon each observation, the researcher would also approach the employee and remind them that their packet would be in the file folder box by the end of the day.

The researcher prepared 43 total packets over the course of the observations. Of the packets distributed, 16 packets were not picked up at all and three packets were not returned. A total of 24 packets were returned to the researcher either by returning them to the file folder box or handing them to the researcher during observations. Of these 24, two packets were discarded because of missing data, including incomplete surveys or behavior maps. This left the researcher with 22 completed surveys and behavior maps from which to draw results.

Step 3: Examine the facts. Step three of the method study process is examining the facts. To examine the facts, the researcher used employee surveys, employee self-reported behavior

maps, and the researcher's behavior maps in order to draw conclusions. The researcher used a modified version of the Gentry (2010) method of data analysis in which the behavior maps of the researcher are compared with the employee behavior maps. Using this method as a guideline, the researcher used a modified layover technique to compare the employees' behavior maps with the researcher's behavior maps. This layover technique was used to determine whether employees are actually using the routes throughout the space they think they are taking. Discrepancies between the researcher's observation maps and employees' self-reported maps were recorded. The researcher summarized the behavior map data in a clinical manner and used narrative inquiry to combine employee surveys with researcher's observations to gather suggestions for future research.

Step 4: Create a new method. Step four of the method study process is to create a new method. The researcher completed this step by making suggestions to improve the workflow process by using the discrepancies and linkages noted between the researcher behavior maps and employees' behavior maps. A report was created for the general manager of the hotel. This report consisted of summarized clinical data and the researcher's suggestions for improving the spatial layout and functionality of the kitchen. The summarized report did not include staff opinions, personal information, or observed discrepancies about particular employees. The researcher presented the report to a team of upper management of the hotel. The researcher answered questions about improvement and made suggestions based on the findings. The researcher understands the suggestions made may not be implemented given the cost associated with the recommendations.

Summary

The purpose of this study is to aid interior designers and food service professionals by

adding to the body of knowledge in spatial layout and functionality. The further purpose is to test a research tool that can be used to establish a benchmark for observing and identifying key productivity hindrances in the physical environment in terms of spatial layout and functionality in the foodservice industry. The researcher used the steps from the method study process defined by Slack et al. (2007) in order to fulfill the purpose. The researcher changed the word "method" to "process" to avoid confusion in this manuscript. The steps the researcher used are as follows:

1. Select the work to be studied
2. Record the present process
3. Examine the facts
4. Develop a new process

In step one, the researcher selected the work to be studied, communicated the research study plan to management, and produced the base map, the observation method, and the paper-based survey.

The tools of behavior mapping, both researcher-conducted and employee self-reported and the paper-based survey, were used in step two in order to identify hindrances of productivity drawn from literature that are defined as: excessive walking, product rehandling, and cross traffic/confusion.

Step three was examining the facts, in which the researcher analyzed the observation behavior maps as well as the paper-based surveys completed by employees in order to create solutions for productivity hindrances and produce suggestions for further research.

The researcher developed a report for upper management with all the results as well as design solutions on how to improve spatial layout and functionality in the kitchen. The researcher presented the findings to the management team and answered any questions

management had about the process or solutions.

In the following section, the researcher goes into detail about what was discovered throughout the study. Extensive data was collected over the course of the 60 hours of observations. For the purposes of this manuscript, the researcher summarizes only those results related to the productivity hindrances of excessive walking, product rehandling, and cross traffic/confusion.

Results

Survey Results

The researcher prepared 43 total packets over the course of the observations. Of the packets distributed, 16 packets were not picked up at all and three packets were not returned. In total, 24 packets were returned to the researcher either by returning them to the file folder box or handing them to the researcher during observations. Of these 24, two packets were discarded because of missing data including incomplete surveys or behavior maps. What remained of the original 43 were 22 viable surveys and behavior maps from which to draw results.

Table 3, on the following page, identifies the location and time frame in which the employee was working when observed. The table also shows how many viable surveys were received per time slot. The greyed out areas signify researcher observation time slots where no usable survey data was collected. For example on Wednesday, June 12, during the observation period from 7:00 am to 11:00 am, two employees who were observed in the bakery section returned viable survey packets.

Table 3

Useable employee survey data identified by location and time slot

TIME 6/10/13-6/20/13	MON 6/10	TUES 6/11	WED 6/12	THUR 6/13	FRI 6/14	SAT 6/15	SUN 6/16	MON 6/17	TUES 6/18	WED 6/19	THUR 6/20	
6-7am								1		2		
7-8am			2	2								
8-9am		4			1				2			
9-10am												
10-11am												
11am-12pm										1		
12-1pm			2									
1-2pm												
2-3pm												
3-4pm												
4-5pm												
5-6pm		3	2						1			
6-7pm												
7-8pm												
8-9pm												
TOTAL HRS	6 hrs	7 hrs	8 hrs	5 hrs	2 hrs		6 hrs	6 hrs	8 hrs	6 hrs	6 hrs	60 hrs

COLOR	SPACE
	Banquet Kitchen
	Bakery
	Restaurant Kitchen
	Dish Pit
	Prep Kitchen

As seen in the table above, at least two employees from each location in the kitchen completed surveys. Survey item one identifies the employee's job title, as shown in figure 12, below.

- Chef de partie (six respondents)
- Pastry chef (four respondents)
- Cook 1 (one respondent)

- Cook 2 (five respondents)
- Cook 3 (three respondents)
- Pastry assistant and Cook 3 (one respondent)

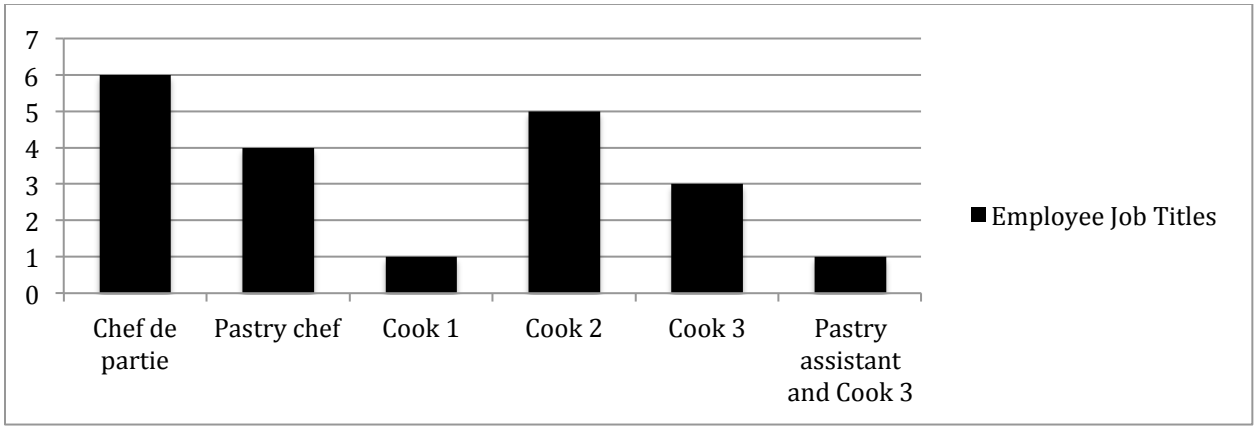


Figure 12: Number of survey responses per employee job title

Survey item two describes the length of employment at the hotel for each employee where the study was conducted, as shown in Figure 13, below:

- 0-6 months (4 respondents)
- 7-12 months (12 respondents)
- 13-18 months (5 respondents)
- Unidentified time frame (1 respondent)

Figure 13: Number of survey responses per length of employment

Survey item three required respondents to answer the following question using a five-point scale: how do you feel about the equipment and tools available to you in the kitchen in terms of being able to complete your job successfully? Figure 14 shows the responses collected from the surveys.

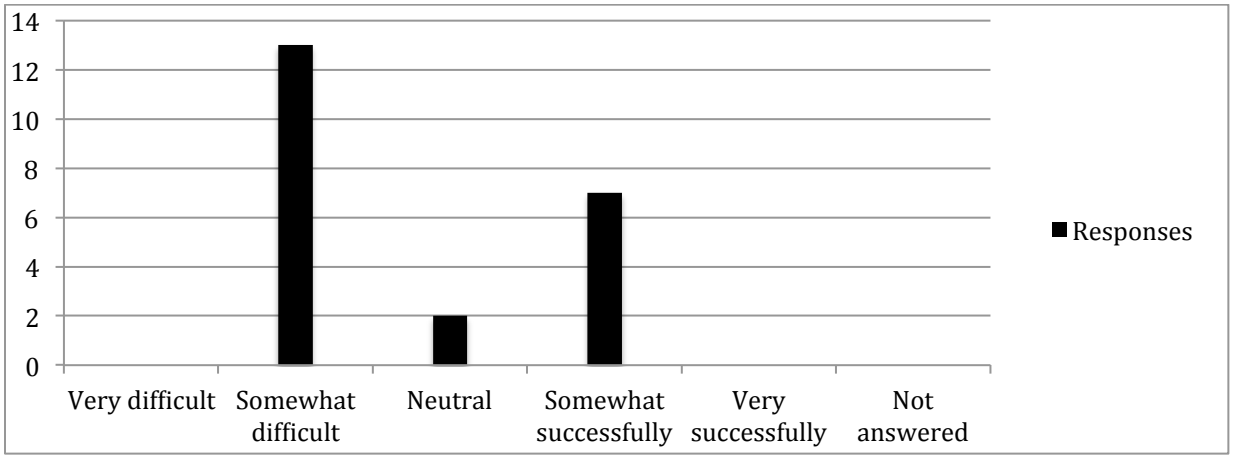


Figure 14: Survey responses to item three on the paper-based survey

More than half of the responses indicated that tools or equipment are causing a difficulty in their job performance. The following open-ended question (survey item four) explores what tools or equipment are missing for the employee to complete their job at a higher level of performance. What tools or equipment, if any, are missing in order for you to complete your job successfully? The following section summarizes employee answers to the survey question. For complete responses, see Appendix O. The following summaries are divided up by location of observation conducted by the researcher. The locations are: banquet kitchen, bakery, restaurant kitchen, dish pit, and prep kitchen (See Table 3 on page 60).

Seven employees working in the banquet kitchen responded to this question. Figure 15, below, shows the location of the banquet kitchen within the kitchen as a whole.

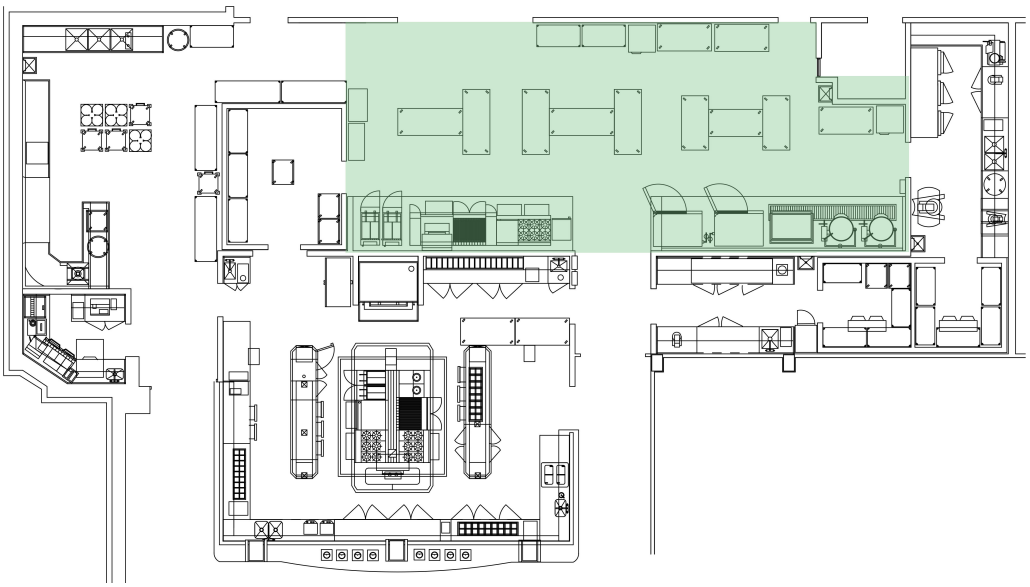


Figure 15: Layout of the banquet kitchen in relation to the kitchen as a whole

Responses to this item indicate that the banquet kitchen may not have enough storage. Respondents also suggested that the banquet kitchen workspace lacks the utensils necessary to complete job tasks. These utensils include pots, pans, spatulas, lids, and tongs. One employee further commented that the tools and equipment in the space are not necessarily missing but rather are out of order. This respondent indicated that employees do not take care of these tools and equipment as they should in order to ensure longevity and efficiency.

The responses to this item also uncovered some inconsistencies between the paper-based survey and the behavioral observations. For example, one of the employees observed in the banquet kitchen during the behavior mapping process was the pastry chef, but the pastry chef's responses to the paper-based survey seem to relate to work conducted in the bakery, as indicated by the following survey answers. For clarity purposes, it is necessary to acknowledge that the kitchen employees commonly referred to the bakery as the bakeshop.

- "inside freezer, bakery oven, bakery stove, better mixers, a door [on the bakeshop]!
- "Bakeshop needs its own oven & own storage area. An outside freezer/cooler in

> Alabama is most impractical and effects quality of product emensly [*sic*]! Bakeshop should have its own mini-stovetop or single induction burner to reduce travel distance w/hot products. One efficient mixer as opposed to three less-than-adequate ones"

It is reasonable that this employee would provide input on the bakery; the pastry chef spends much of the time in the bakery, which is directly connected to the banquet kitchen. Figure 16, below, shows the bakery (identified in purple) in relation to the banquet kitchen (identified in green). The pastry chef and pastry assistant were observed in the banquet kitchen, and not the bakery, during the time corresponding to the survey.

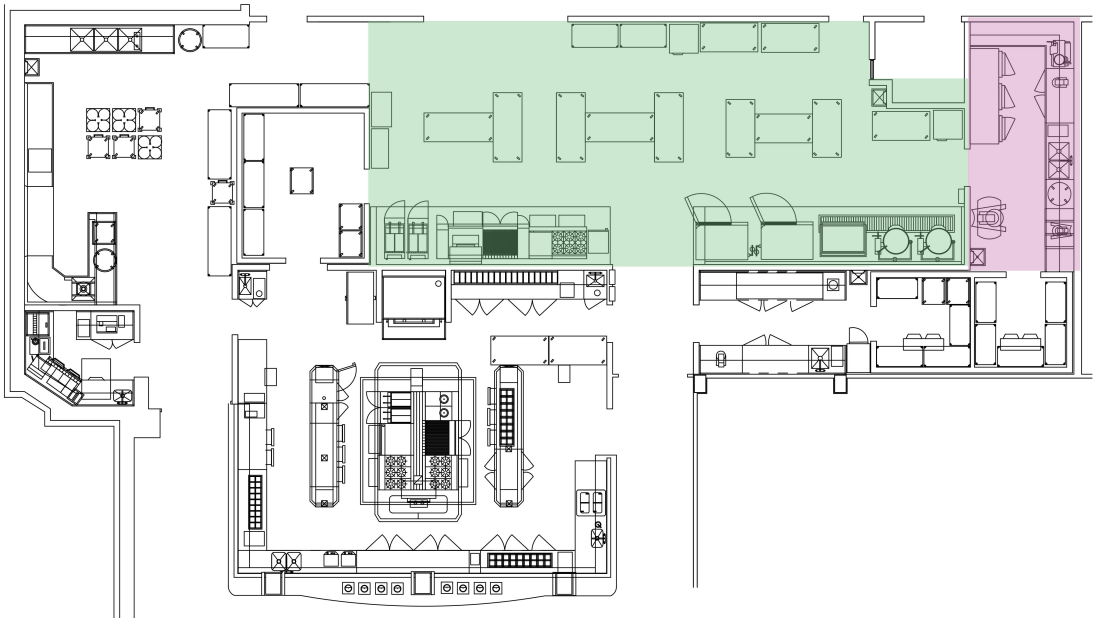


Figure 16: Relationship between banquet kitchen and bakery

Three employees working in the bakery responded to this question. All of the respondents stated that the bakery needs its own dedicated oven. Respondents also indicated that work could be completed more successfully with the addition of a freezer, more storage and table space, better mixers, and an ice cream maker.

Four employees working in the restaurant kitchen responded to this question. One

respondent cited a need for burners at the pasta bar. Two respondents pointed out a need for pans, ladles, bowls, and plastic lids for tomatoes. One respondent stated that food storage was a major issue and that appropriately sized food containers were needed to resolve this issue.

Two employees working in the dish pit responded to this question. Both respondents indicated that gloves were needed in order to complete their work tasks successfully. One respondent commented that the ambient temperature in the dish pit area is too high. This respondent suggested that lowering the temperature of the workspace would make the dish pit work environment more pleasant.

Three employees working in the prep kitchen responded to this question. The most common issues among these three respondents were the lack of storage space and the insufficient quantity of small wares. One respondent observed that the employees bring tools from home to create a more successful work environment. A complete account of all responses for item four can be found in Appendix O.

Survey item five was answered using a five-point scale: To what degree is the amount of space you have to work in helpful in doing your best work? Figure 17 shows responses found in the employee surveys.

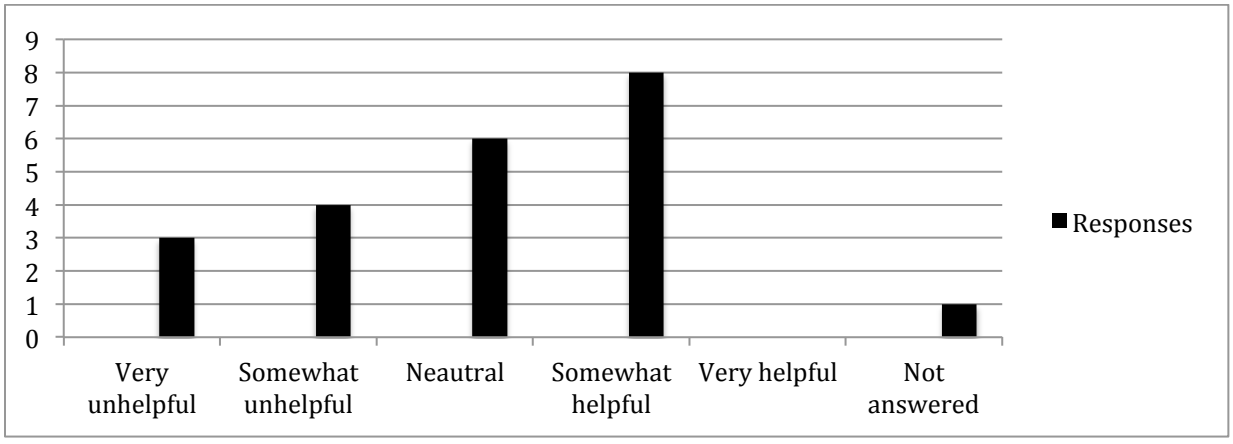


Figure 17: Survey responses to item five on the paper-based survey

Survey responses indicate that seven of twenty-two respondents felt the amount of space provided was somewhat or very unhelpful to doing their best work. Eight respondents felt the space was somewhat helpful, and none found it very helpful. Six were neutral.

Survey item six was open-ended: are there any changes to the physical environment that you wish you could make in order to do your job more effectively? Two respondents from the banquet kitchen stated that there was too much space and one suggested that less walking would provide for a more efficient work environment. Another respondent stated that moving the cooler and freezer from the exterior of the building to the interior of the building would save a great deal of time. Once again, for this question, the pastry chef and the pastry assistant provided answers that were focused on the bakery alone despite being observed in the banquet kitchen. These answers were in direct opposition to those of other respondents from the banquet kitchen, as shown below:

- More storage space (cooler/dry), bigger shop, more table space
- Of course everyone wants more space. The bakery is average in size but [if] a more efficient mixer was utilized then more table space would be available. Storage is always needed.

All three respondents from the bakery identified a need for more table space as an improvement to the physical environment and necessary to complete their jobs more effectively.

One respondent from the restaurant kitchen used an exclamation point in conjunction with a statement that the load-bearing column should be moved out of the kitchen. Two respondents raised a generalized point that the entire kitchen complex is too spread out, resulting in workplace challenges related to movement from workspace to workspace and, in particular, for employees responsible for running more than one area of the kitchen at a time. Respondents from

the dish pit indicated that they did not have any changes they wished to make to the dish pit work environment.

One respondent from the prep kitchen observed that her fellow workers had created a secondary spice rack in this section of the kitchen to reduce travel time. This respondent also expressed frustration that other employees have since discovered this spice rack and made liberal use of a resource intended for specific employees. One respondent restated a need to move the exterior cooler and freezer inside and one respondent suggested that more storage in this prep kitchen would lead to less walking. A complete account of all responses for item four can be found in Appendix O.

Item seven was answered on a five-point scale: if the changes to the physical environment mentioned above were made, do you feel like you would be a more satisfied employee? See Figure 18 for the responses collected from the survey.

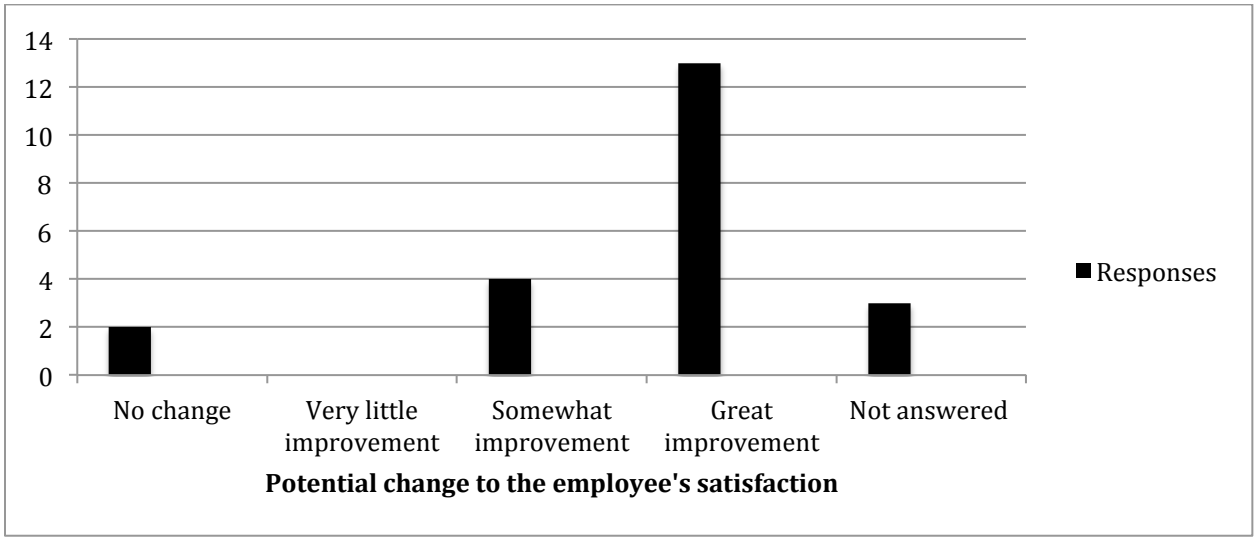


Figure 18: Survey responses to item seven on the paper-based survey

Survey responses indicate that seventeen of twenty-two respondents felt that there would be some degree of improvement to their workplace satisfaction if their suggested changes were made. Only two felt that there would be no change to their satisfaction. The responses to this

item suggest that, if changes to the physical environment are made, there is a potential for an increase in employee job satisfaction. As previously stated in the literature review, an increase in employee job satisfaction could potentially lead to improved employee retention and thus improve the hotel's bottom line.

The final item, item eight, was an open-ended question: What other comments would you like to make about the layout of your workspace in the kitchen or the kitchen as a whole? The responses to this item were highly generalizable and therefore difficult to associate with a single area of the kitchen complex unless specifically identified as such. These broadly stated responses could derive from the fact that it is not uncommon for an employee to work in different areas of the kitchen throughout a shift. For example, during observations in the prep kitchen location, respondents indicated, "it is a big area." Figure 19, below, shows a photo of the prep kitchen.

Figure 19: Photo of the prep kitchen from the viewpoint of the doorway in the hallway

It is not a big area. Through observations, the researcher concluded that cooks in the prep kitchen often work in the restaurant kitchen during the same shift. The following summary of responses in Table 4 is organized by the observation point of view of the researcher at the time

the survey respondent was observed:

Table 4

Responses to survey question eight on paper-based survey: suggestions for physical changes

Location of observation	Responses
Banquet Kitchen	• Not good for one or two people. Designed for four people. • Hot boxes are not located in the proper locations. We must walk away from our workstations to access them. • N/A • It's a tight squeeze • The bakeshop is spread as thinly as possible. If there were more room then a rearrangement/equipment addition would be a great improvement
Bakery	• Tight fit
Restaurant Kitchen	• Spaces around pizza line & oven are tight, as well as by pasta & salad. More space would definitely help in my opinion • It is very tight, and cold stations such as salad and dessert should be next to each other if one is working both • It is very tight, and cold stations such as salad and dessert should be next to each other if one is working both (employee gave repeat answer on two surveys) • Hard for 1 or 2 people to run [kitchen]. It is set up for 4 people
Dish Pit	• (No comments were made on this question by employees observed in the dish pit location)
Prep Kitchen	• It is a big area. It is not set up for a 1 or 2 person operation. It is a rat trap if a lot of ala carte orders come in. Running around instead of lateral movements. There should not be 4 lines. 1 line and 4 stations would be much better. • Organization is an issue, too many changes made weekly making it confusing & time consuming to find items • It is not set up for a 1 or 2 person operation. It is only set up for a full crew • Kitchen needs a redesign due to change in time

Based on the responses to this final item, some generalized conclusions can be drawn about the work environment in the kitchen complex. Overall, respondents indicated a lack of storage space. Responses indicate that employees may have a hard time keeping track of the resources they are given in the kitchen and that some employees bring equipment from home to complete

their required tasks successfully. Space allocations do not seem to align with employees' perceived needs for work tasks. Respondents suggest that too much space is a problem in some areas of the kitchen and that there is not enough space in others.

The second part of the paper-based survey asked employees to complete a self-reported behavior map. The instructions the employees were given for this behavior map are as follows: "Thinking of the work you did tonight, use the marker provided to mark your path around the kitchen. Note any places in the kitchen that you have challenges, such as:

- Draw multiple walking lines if you repeatedly walk in one location
- Circle problem areas in the kitchen and briefly explain the issue
- Place a star next to any places you run into other employees"

The researcher collected twenty-two completed employee self-reported behavior maps. The research conducted using the self-reported behavior maps was explorative and qualitative in nature. No conclusions were quantified, but several patterns emerged. The most commonly reported productivity hindrance found on the self-reported behavior mapping process was cross traffic/confusion. Seventeen of the twenty-two useable behavior maps indicated points of collision in the kitchen. Although not specifically indicated on the maps, the data collected from the behavior maps can be interpreted to mean that excessive walking is a major problem in this kitchen. Eighteen of the twenty-two behavior maps indicate the employee walking to all five subsections of the kitchen during a shift. All twenty-two of the behavior maps show the employees moving into at least three subsections of the kitchen throughout a shift. This means that the employee had to leave their work area to collect resources from other areas of the kitchen. The time spent walking to resources is unproductive.

The paper-based survey was successful in identifying some employee-perceived problems

in the kitchen, but the survey instrument was less successful in soliciting solutions to these problems. In the next section, the researcher will summarize the results from the researcher-conducted behavior mapping.

Summary of Behavior Mapping Results

The results of this study reveal several trends that correlate with trends in the literature that are labeled hindrances of productivity. The literature states low productivity in the foodservice industry is caused by three main problems (Kahrl, 1975):

1. Excessive walking
2. Product rehandling
3. Cross traffic/confusion

From the behavior maps, the researcher concluded excessive walking was the leading problem for the kitchen observed during the study, followed by cross traffic/confusion. These findings align with what is known from the existing literature. For example, Kahrl (1975) states that the average employee in the restaurant industry spends 25% of their working hours walking.

During the behavior mapping process, the researcher developed a shorthand method of annotation based on terminology used by the observed kitchen employees. This terminology, while common in the foodservice industry, may be unfamiliar to the reader. Therefore, the following section will describe some of these terms and their relationship to the observation method for clarity.

The phrases “before service” and “during service” refer to the time before food is being served and during which food is being served to customers, respectively. For example, if the restaurant opens at 7:00 am for breakfast, 6:00 am to 7:00am would be before service. The functions that occur during this time period may include baking, meat preparations, vegetable

preparations, and cooking. Specific behaviors within these functions may include multiple tasks that prepare the chefs to conduct their functions during service. When a table of customers orders a meal, the chefs have a limited amount of time to prepare all the entrées. Because time efficiency is important, chefs and cooks spend the hours before service preparing for the fast-paced environment of during service. Similarly, "after service" refers to the time after food is being served to customers and may include the functions of pot washing and cleaning. The researcher observed that after service behaviors include cleaning all areas of the kitchen: floors, walls, pots, knives, cutting boards, counters, stoves, ovens, and all storage areas. Throughout the researcher's behavior maps and written results, the terms "before service," "during service," and "after service" became useful shorthand to identify possible relationships between functions, behaviors, and tasks.

The results of the behavior mapping process are organized into the three main productivity hindrances. As previous listed above, these hindrances are: excessive walking, product rehandling, and cross traffic/confusion. Within each category, the researcher first describes the factor in detail and provides examples of specific observations. Next the researcher provides analysis of the problem and proposes solutions to reduce or eliminate the problem and improve productivity. These proposed solutions are informed by knowledge gained through the literature review, expert knowledge, knowledge gained through 60 hours of direct observation, and knowledge gained through incidental conversations between the researcher and employees. The first trend to be discussed is excessive walking.

Excessive Walking

As shown in the literature, excessive walking is one of the major hindrances of productivity. The time spent walking was itself time that could have been used for more

productive behaviors. Excessive walking may also lead to other problems that hinder productivity. Excessive walking gives employees time for their minds to wander and can lead to employees forgetting what they were in the process of doing. The concept of employee confusion will be discussed further in the cross traffic/confusion section of these results. For this section, the researcher focused only on the actual act of excessive walking, which is defined as an inhibitor of productivity in which the employee walks more than necessary to complete a task efficiently (Kahrl, 1975).

Excessive walking was easily the top-ranked productivity hindrance observed in the kitchen studied by the researcher. Walking was deemed to be excessive when there was no clear link between the act of walking and the tasks and behaviors inherent to the function at hand. On every observation day, during every time, and from every observation point, the researcher observed one or more employees walking excessively. Some of the most severe examples of excessive walking are provided in the following examples for further explanation. They are not ranked in order of importance.

Observation: Sink in banquet kitchen. The banquet kitchen is an area used by all of the kitchen employees. All employees must walk through the banquet kitchen to get to other parts of the back of house. Figure 12, on page 63, shows the banquet kitchen in relation to the kitchen as a whole. The banquet kitchen houses two, large industrial ovens that cook the majority of the food used for both the restaurant and banquet events. Even the pastry chef, who has a private work area in a separate section of the kitchen, uses the ovens in the banquet kitchen. There are eight total prep (short for preparation) tables within the banquet kitchen. These prep tables are not secured to one location on the floor; they can be moved around to accommodate the needs of the staff. See figure 20, below.

Figure 20: Photo of the banquet kitchen prep tables

Prep work for both banquets and for the restaurant occurs in this space. There is one hand-washing sink in the banquet kitchen. This hand-washing sink is used by all of the kitchen employees who are using the banquet kitchen for food preparation or cooking. Observations revealed that this hand-washing sink is used quite often. The in-room dining staff that shares a small space in the kitchen for their duties also uses this sink. Figure 21, below, shows the placement of the sink in the banquet kitchen.

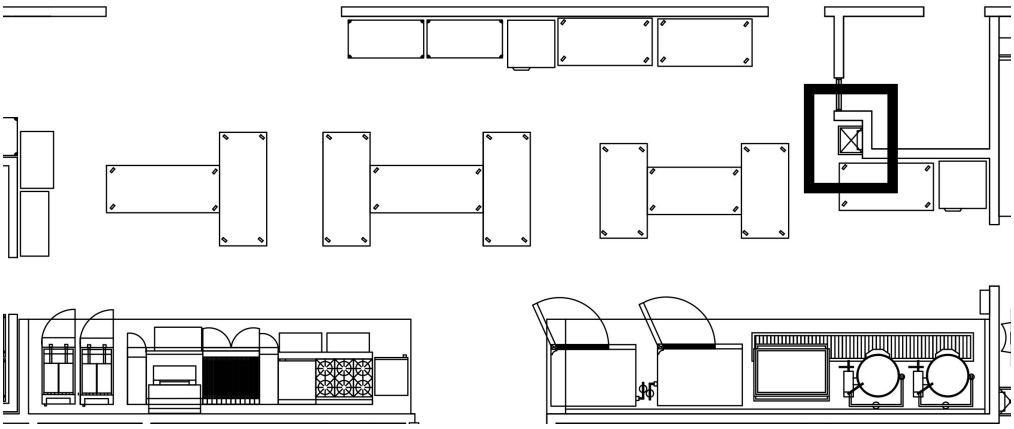


Figure 21: Current location of the sink in the banquet kitchen

The main behavior observed at this sink is employee's washing their hands, but there were

several other tasks conducted here, such as an employee rinsing a knife (example: June 10, 11:00-11:22 am, Appendix P) and filling a pot with water before putting it on the stove (June 16, 9:46-9:52 am, Appendix Q) or the in-room dining staff wetting paper towels in order to wipe down trays (June 20, 8:48-9:02 am, Appendix R).

The researcher observed the banquet kitchen for a total of 18 hours from several different points throughout the space. Within that time period, the researcher observed employees moving towards the sink a total of 86 times. Of the 86 times the sink was approached, the researcher observed that 40 of these times the employee either came from or returned to the opposite side of the kitchen. In Figure 22, the blue-shaded area represents what the researcher describes as the opposite side of the kitchen.

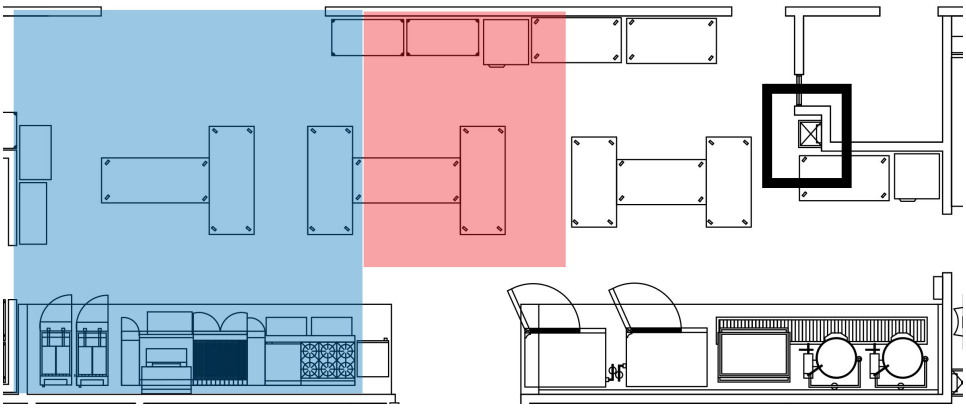


Figure 22: Defining middle (red) and opposite side (blue) of the banquet kitchen

The red-shaded area in figure 22 is considered the middle of the banquet kitchen. The researcher observed employees coming from or returning to this area of the kitchen eight out of the 86 times. The main reason employees are walking from one side of the kitchen to the other to reach this sink is because this is the only sink in the space. The employees have access to sinks in the dish pit but those sinks are not conveniently located to the banquet kitchen. The issue of having only one sink in the kitchen and of nearly half of its use (40 of 86 times accessed) being

by employees who work on the opposite side of the banquet kitchen is one of the primary contributors to the larger problem of excessive walking in this workspace. The problem of excessive walking to and from the single sink in the banquet kitchen, as identified through the researcher's behavior mapping, was not identified in the paper-based survey nor the self-reported behavior mapping.

Proposed solution: Sink in banquet kitchen. The researcher proposes that a second sink be added to this banquet kitchen space to reduce excessive walking by the employees. The researcher suggests that the best place for this sink would be on the wall opposite to the current sink. Plumbing may be a problem in this area (A) because of the walk-in refrigerator being located on the other side of the wall, so the researcher suggests an alternative location (B), shown in Figure 23.

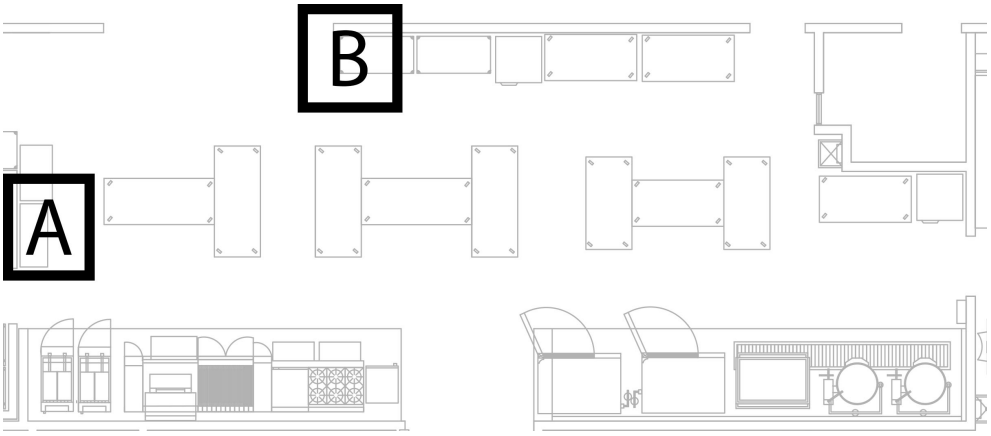


Figure 23: Suggestions for an additional sink locations (A, B) in the banquet kitchen

The banquet kitchen is located in the back of the kitchen, whereas the restaurant kitchen is the part of the kitchen located closest to the restaurant. The restaurant kitchen is an open-plan kitchen, open on three sides, that allows customers to watch the cooking process. The following section focuses on the restaurant kitchen and a specific area where employees seem to be walking further than necessary to complete their tasks.

Observation: Pizza oven in restaurant kitchen. Overall, excessive walking is a problem in the entire kitchen but especially in the restaurant kitchen. The researcher met with one of the executive sous chefs before the start of the study to receive approval for kitchen access. The executive chef stated that this particular restaurant kitchen was built to function with seven employees. The kitchen had been designed with the intent to sell enough food during service on a daily basis to require a fully staffed kitchen, which in this case would be seven employees. However, this particular restaurant is located in a seasonal community where some periods throughout the year are slow and others are busy. The executive sous chef stated that the kitchen rarely runs with a full, seven-person team; typically three to five cooks are used during time of service. Over the course of the study observations revealed that at any time a minimum of two cooks and a maximum of five cooks were working in the restaurant kitchen. Figure 24, below, shows the location of the restaurant kitchen within the context of the whole kitchen.

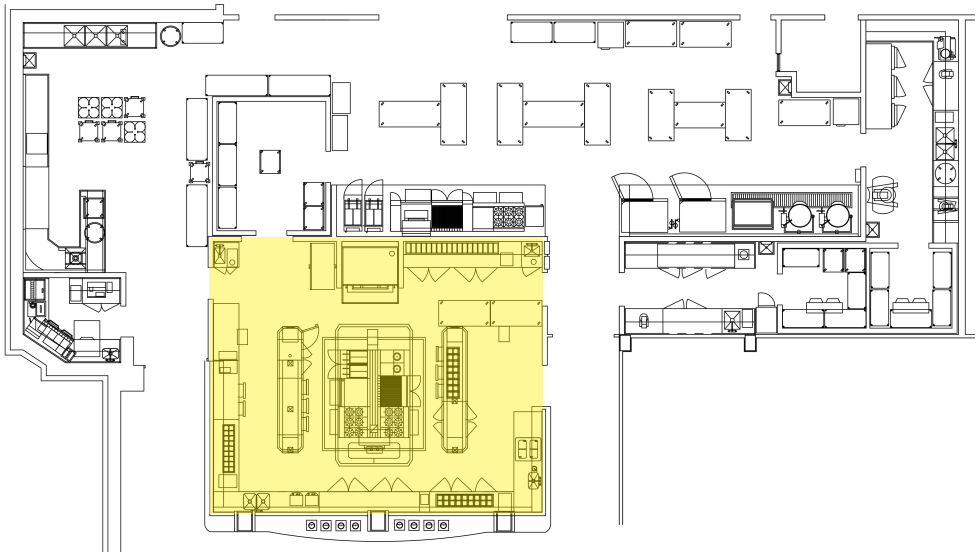


Figure 24: Location of the restaurant kitchen in relation to the kitchen as a whole

The researcher observed that, unlike the banquet kitchen with its moveable preparation tables, the restaurant kitchen is not a flexible space. It seemed that during observations, even when the number of customers being served was not high and business was slow, the cooks were

constantly rushing around at a rapid pace. After conducting observations, the researcher suggests that the ability of the cooks to conduct their jobs is negatively influenced by how much they have to walk to reach equipment and resources. Excessive walking was identified during behavior mapping. Employee feedback provided via the paper-based survey did not specifically indicate excessive walking, but the self-reported behavior mapping portion provided some data that could be interpreted as an indication of excessive walking, as shown in the example in Figure 25, below.

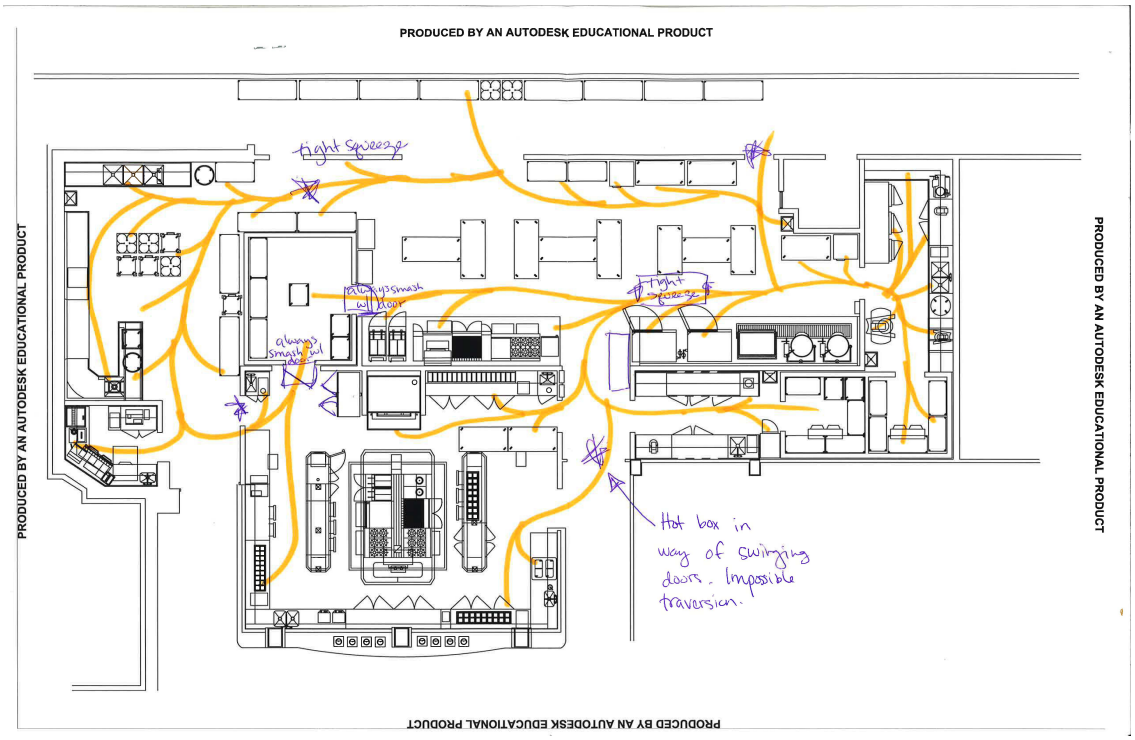


Figure 25: Self-reported behavior map indicating excessive walking

The researcher identified areas of excessive walking in the restaurant kitchen through behavior mapping. One example identified as a problem area involving excessive walking was the pizza oven. The location of the pizza oven is shown in Figure 26 and a photo of the pizza oven is shown in Figure 27, below.

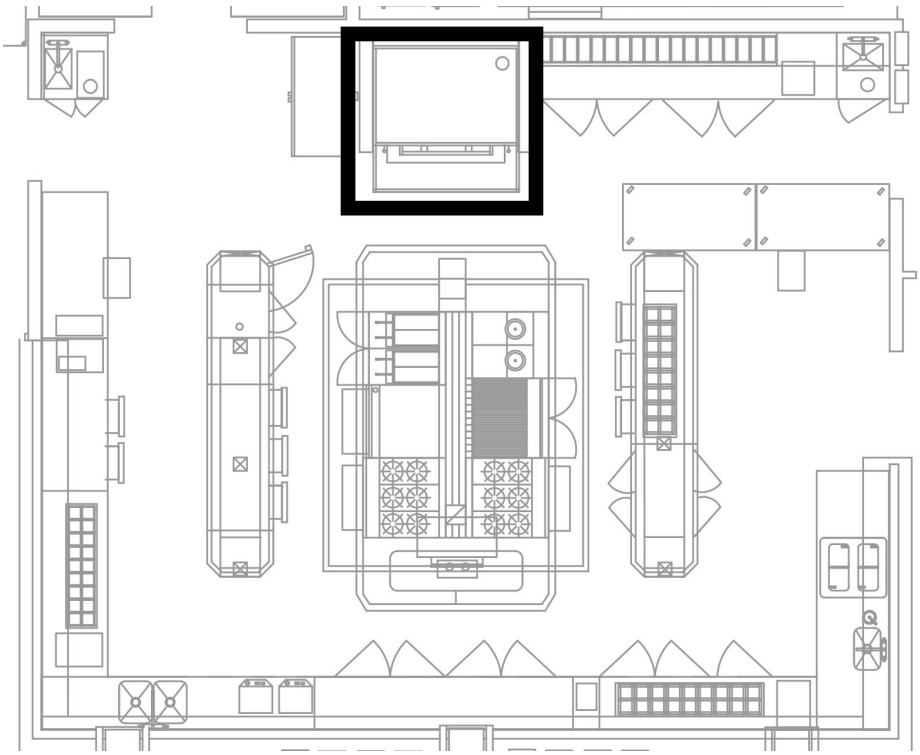


Figure 26: Location of the pizza oven in restaurant kitchen

Figure 27: Photo of pizza oven in restaurant kitchen

The researcher conducted 17.5 hours of observation from different observation points within the restaurant kitchen. The researcher observed breakfast, lunch, and dinner service.

During the observations conducted by the researcher, breakfast service was managed by two employees in the kitchen, lunch service by two employees, and dinner service by three to five employees. Of the 17.5 hours observed, employees approached and departed the pizza oven 79 times. Although the researcher observed the employees at the pizza oven more than 79 times, the researcher discarded observations if only an approach or departure, but not both, was recorded. These observations were considered only partial observations because some only clearly indicated where the employee came from or where the employee returned to, not both of these movements. It is therefore possible that the actual frequency of access to the pizza oven is much higher than this conservative representation. The researcher recorded several employee behaviors at the pizza oven. These behaviors included:

1. Checking the oven without inserting or removing anything
2. Inserting something, typically pizza but sometimes plain dough or other pans of food
3. Removing something, typically pizza but sometimes plain dough or other pans of food
4. Hesitating, standing in front of the oven and doing nothing

When analyzing the data, the researcher documented what area of the kitchen the employee came from and which area the employee returned to after using the pizza oven. For analysis purposes, the researcher divided the restaurant kitchen into subsections. Figure 28, on the following page, shows these subsections.

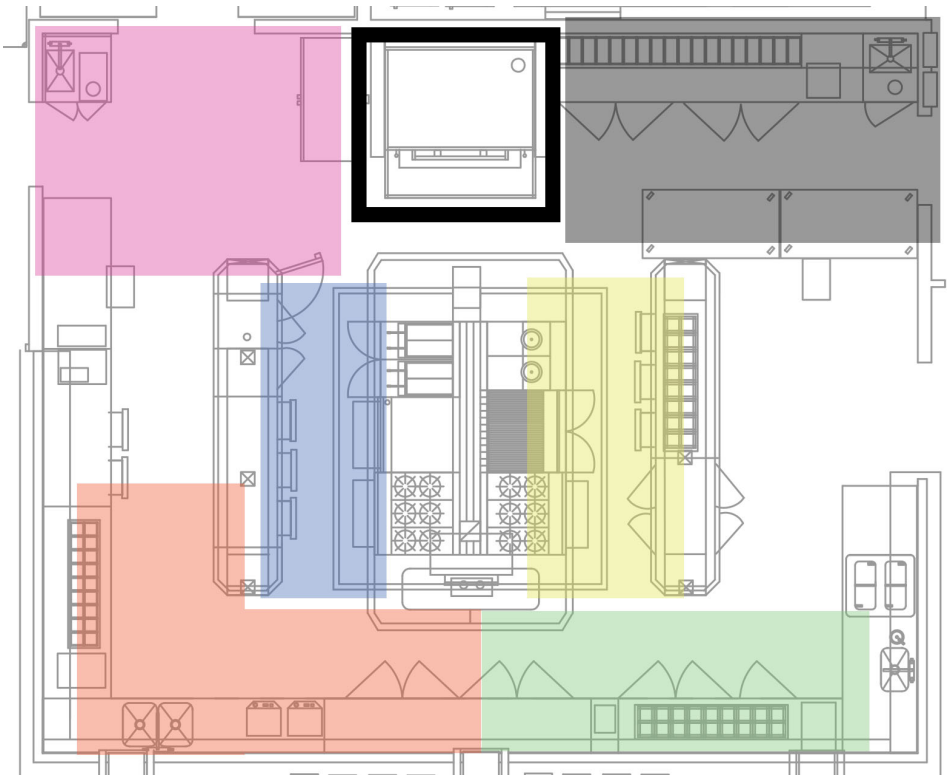


Figure 28: Color-coded subsections of the restaurant kitchen

In the analysis of these subsections, each was assigned a color and a name:

1. Pizza Station (Grey)
2. Front/Right (Green)
3. Front/Left (Orange)
4. Mid/Left (Blue)
5. Mid/Right (Yellow)
6. Back/Left (Pink)

One way to combat excessive walking would be for employees to have all the required resources in every subsection. Ideally, an employee would stay in one subsection to conduct all behaviors necessary to complete their kitchen function. When an employee walks between subsections in order to conduct behaviors or retrieve resources, the employee is taking potentially unnecessary steps, which could lead to excessive walking that decreases the

employee's productivity. The researcher observed employees approaching or departing the pizza oven 79 times. Of these 79 times, 50 involve the employee both coming from and returning to the pizza station. In other words, the employee stayed in one subsection to complete the behavior. In 29 of the 79 times, employees came from or exited to another subsection of the kitchen. In summary, 36% of the time employees are not staying in the subsection in which the pizza oven is located. Employees moving between subsections mean that more steps than necessary are being taken in order for the employee to complete the kitchen function involving the pizza oven. The researcher observed employees sometimes even running from other subsections to get to the pizza oven before the food in the oven burned.

Proposed solution: Pizza oven in restaurant kitchen. The problem with the pizza oven is a specific example of the larger problem of excessive walking found in the restaurant kitchen zone. The researcher observed that the kitchen space is too large for the number of regularly scheduled employees. Employees come from different subsections of the restaurant kitchen zone in order to complete necessary job functions. For example, during a twelve-minute window of time on June 11 (6:03-6:15pm, Appendix S), one employee came from the front/left area of the kitchen, checked the pizza oven, returned to the front left, then repeated the same path to retrieve the food from the oven and bring it back to the front left. The employee's path is shown in Figure 29, below.

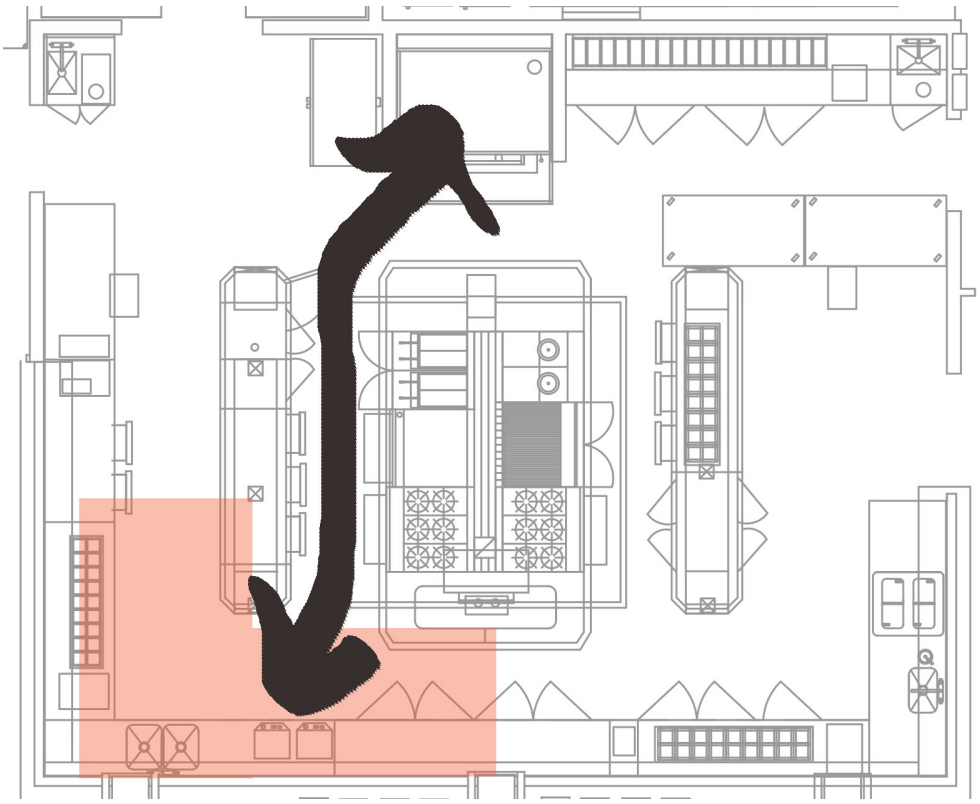


Figure 29: Employee's path between pizza oven and front/left restaurant kitchen subsection

Further observations need to be conducted to determine the different uses for the pizza oven. If food other than pizza is being cooked in the oven, further investigation into the specific behaviors related to this food preparation should be considered. For example, if an oven in another section of the restaurant kitchen is broken, employees may be using the pizza oven as a second option. If overcrowding of an oven sends the employees to the pizza oven as an overflow, the addition of another basic-use oven to the restaurant kitchen may be beneficial. One solution to the problem of excessive walking involving the pizza oven would be to schedule another employee to work only in the pizza subsection, allowing employees to stay in their own areas and conduct the tasks only associated with their specific area. This solution may not be the most cost-effective considering the lifetime costs of increased labor hours and should be balanced with the savings accumulated through increased efficiency for other employees. Another solution to

the pizza oven problem requires a higher up-front cost with the potential for long-term savings. This solution involves reconfiguring the restaurant kitchen so that the zones located most remotely within the kitchen can be left unused during the off-season. This would reduce the effective square footage of the restaurant kitchen and thus decrease walking distances from one active zone to another. As previously stated, the restaurant is seasonally busy, therefore a flexible kitchen would reduce the amount of walking employees have to do during the slower seasons, when fewer employees are scheduled. One of the challenging parts of increasing efficiency in this kitchen is that because the restaurant serves breakfast, lunch, and dinner all week the kitchen needs to accommodate all kinds of food service. The researcher proposes that the kitchen layout be reconfigured in order to shut down parts of the kitchen during slower times of service throughout the day while still offering employees full capabilities. To this end, the researcher suggests additional observation be conducted to include all times of service during all levels of activity in order to produce the most successful plan for renovation. The observation discussed in the next section will give another example of excessive walking.

Observation: Exiting and entering the bakery. The restaurant kitchen has a pastry chef who works alone at times and with an assistant at other times. The pastry chef conducts all prep work and finishing touches to the pastry items in the bakery. The researcher observed the bakery on two separate occasions, once in the morning (Wednesday, June 12 from 7:15-10:15 am) and once around lunchtime (Wednesday June, 19 from 11:48 am-2:49 pm). No evening observations were conducted in the bakery because the pastry chef leaves in the afternoon. Any pastries used during dinner service are prepared by the pastry chef or pastry chef assistant earlier in the day. Figure 30, below, shows the placement of the bakery in relation to the rest of the kitchen.

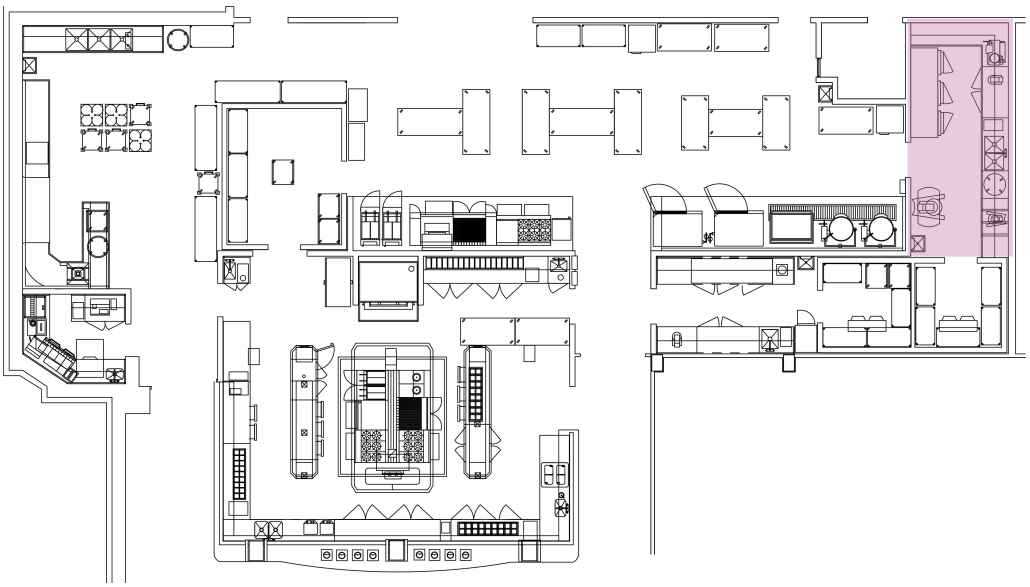


Figure 30: Location of the bakery in relation to the kitchen as a whole

After conducting observations in the bakery, the researcher concluded that the pastry chef's time schedule is uniquely independent of the rest of the restaurant schedule. The schedules of the hotel and restaurant influence the pastry chef's schedule just like they do to the rest of the kitchen, but the items that the pastry chef prepares are always prepared ahead of time. Therefore the pastry chef is busy at different times than the rest of the kitchen employees. The researcher did not observe any items being prepared during service. For example, the pastry chef is required to make cheesecake for the lunch buffet served daily in the restaurant. The pastry chef may make the cheesecake on Tuesday afternoon and cut the cheesecake to put it on a presentation dish Wednesday morning. The presentation dish can then be wrapped in plastic wrap and stored in a walk-in refrigerator so that the server can access the presentation dish whenever necessary during service. This self-paced schedule is unique to the pastry chef; no other kitchen employee has as much control over the schedule in other parts of the kitchen.

While observing in the banquet kitchen, the researcher noticed that the pastry chef and the pastry chef's assistant left the bakery numerous times throughout the day. The majority of the

resources for the pastry chef are housed in the bakery. The researcher observed four main reasons the pastry chef and pastry chef's assistant left the bakery:

1. To throw things in the trashcan, located just outside the bakery door
2. To use the ovens located fairly close to the bakery door
3. To go to the dish pit to put dirty dishes away
4. To collect resources such as mixing bowls, spoons, spatulas, serving platters, and presentation dishes

Figure 31 shows the kitchen as a whole, with the above areas identified.

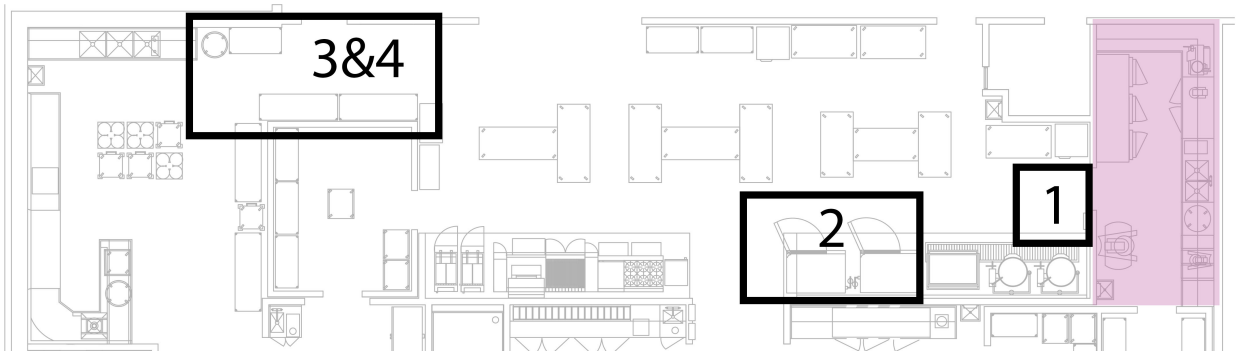


Figure 31: Areas the bakery employees access in order to retrieve resources

The researcher addressed how many times the pastry chef and pastry chef's assistant went outside of the bakery over the course of the six hours of observations that were conducted in the bakery. When analyzing the data, the researcher coded for five main behaviors of the two employees that used the space. These behaviors were:

- TC: accesses trashcan
- XW: exits with something in hand
- X: exits empty handed
- RW: returns with something in hand
- R: returns empty handed

Although sometimes noted during observations, analysis of the data did not include what

the employee carried in or out of the bakery. The researcher placed primary emphasis on the simplified behavior of entering (RW) or exiting (XW) with an item in hand because this indicated that the employee had to go outside their kitchen zone to complete a task. Excessive walking is a direct result of how frequently the employee must move between kitchen zones. During analysis of the data, the researcher concluded that "accesses trashcan" (TC) was a specific behavior defined by the employee leaving with something to throw in the trash and immediately returning empty handed to the task being conducted in the bakery. The researcher observed the employees conducting this behavior 54 times during the six-hour observation period. Although the trashcan is not far away from the bakery, it still requires extra steps outside of the primary work zone. When these small TC trips are added up, they could be considered excessive walking.

Excluding times the employee went to and from the trashcan, the researcher observed the two employees entering the bakery 47 times and exiting 75 times. Out of the 75 times either employee exited the bakery, the employee had something in hand 22 times. The data shows that over the course of a six-hour time period, the two employees went outside of their work area 22 times. Because the pastry chef and pastry chef's assistant are producing foods that are stored in other areas and served outside of the bakery, this number may not be very significant. However, the data on how often the employees returned with things in hand is very important. Of the 47 times the employees returned to the bakery, the employee was carrying something 24 times. This number is important because it shows that 51% of the times that the researcher observed the employees returning, they returned with resources needed to conduct their tasks. Some of these resources included serving dishes, mixing bowls, utensils such as spatulas, pans, and dough molds. It appears that although the pastry chef and pastry chef's assistant have the food items in

the bakery necessary to conduct their tasks, the tools required to complete their kitchen functions may be located in other parts of the kitchen complex. Another source of excessive walking is the location of the dish pit on the opposite side of the kitchen from the bakery.

Proposed Solution: Exiting and entering the bakery. The researcher proposes time be spent reorganizing the bakery to decrease excessive walking. This would include conducting an inventory of items used on a daily basis. Items that are seldom used would be stored in areas out of the bakery. In the banquet kitchen, outside the bakery door, there is a stand-up cooler with a small table next to it. Over the course of the banquet kitchen observation hours, the researcher observed that this table with the equipment on it was used very rarely. Figures 32 and 33, below, show the location of this table in relation to the bakery.

Figure 32: Photo of door leading into the bakery (center) and the table (left)

Figure 33: Close-up photo of rarely used table, located in banquet kitchen

The researcher proposes that this table and its equipment be moved to another location, possibly in the hallway adjacent to the banquet kitchen. In its place the researcher proposes that storage space be constructed for the pastry chef. This storage could include pans and other resources. This storage should be stocked by the steward or by the pastry chef or pastry chef's assistant using a cart each day. By using a cart, the employees can stock a large amount of resources at one time, saving the employees walking distance and time.

The researcher also suggests that management invest in two small trashcans on casters so the bakery employees can have a trashcan right next to them while completing tasks within the bakery. By putting these trashcans on casters, the employee can move them around the bakery as necessary. Because an employee is already responsible for emptying the existing trashcan,

replacing the large trash can with two smaller ones should not require a significant amount of additional labor. The size of the current trashcan prevents the employees from bringing it into the bakery space. Having two smaller ones would provide both employees in the bakery and main kitchen access to a trashcan at any given time throughout a shift.

Observation: Hesitates. One of the behaviors observed quite regularly was hesitation. For the purposes of this study, the researcher used the term "hesitate" to describe the behavior of pausing for no apparent reason in the middle of a behavior or task. This pause also typically involved a change in direction of travel.

It was frequently observed that employees would walk away from a task and begin heading in one direction only to stop and pause for a few seconds and then go off in another direction. The researcher recorded "hesitates" a total of 94 times over the 60 hours of observations (see Appendix J). The data from this study shows that this behavior occurs more often when employees are busy. For example, June 16 was Father's Day, and the researcher observed the banquet kitchen from 9:00 am-12:00 pm. This time was busy for the hotel as a whole and especially for the restaurant. In fact, during this observation time the researcher, acting alone, was unable to document and record everything going on in the space.

Because watching and recording every behavior by every employee was impossible, the researcher focused on three key employees, documenting their specific behaviors. Over the course of the three-hour observation period, these three employees were observed hesitating a total of 27 times. The researcher proposes that this behavior may occur when an employee needs a resource and is walking far to retrieve this resource, thus causing the employee to forget what they are doing and switch to another task. The researcher further suggests that providing employees with decentralized resources may limit the number of times an employee has to leave

their designated workstation. The justification for this solution is that the fewer times the employee leaves the workstation, the fewer chances there are for the employee to forget what they are doing, and consequently fewer instances of the hesitation behavior.

The researcher proposes that conducting workstation-specific observations could assist in determining which employees use which resources on a regular basis. Conducting these additional observations would also allow the researcher to develop a list of the resources that the employees would most benefit from having decentralized.

Summary of Excessive Walking. Employees seem aware that they walk a lot, but do not seem to be able to self-identify solutions to their excessive walking. As detailed above in the paper-based results section, employees identified what resources they needed. Further observations may be helpful in determining which of these employee-listed resources need to be relocated or replaced in order for the employees to complete their work successfully. The behavior mapping and paper-based survey results align in revealing that not all of the necessary equipment and tools are present and easily accessible for employees to complete their tasks successfully. Further investigation could include a discussion with each employee on what tools and resources are needed at each workstation.

After conducting observations, the researcher concluded that the employees may have adapted to the problems and challenges of the kitchen. As a result, they may be less aware of the negative impact these hindrances have on their ability to complete their work. The information gathered in this study suggests that employee insight is helpful but incomplete unless supplemented with behavior mapping. The researcher therefore proposes that the observation tool of behavior mapping, in combination with employee feedback, is a successful model for identifying what changes need to be made to a commercial kitchen space in regard to excessive

walking.

Employees are not producing when they are walking, therefore excessive walking leads to a decrease in productivity. In this decentralized full-service hotel kitchen, observation suggests that the employees spend an unnecessary amount of time walking to resources that are in centralized locations throughout the kitchen. The researcher acknowledges that the ideal of having all resources at the fingertips of each employee is a costly solution that should be balanced against other factors to provide the best return on investment.

The researcher proposes that one solution would be to equip each workstation with the tools and resources for the employee to conduct their tasks. Alternately, resources could be divided among subsections and zones to reduce the overall distance employees must travel. Another low-cost solution could be to provide resources in a location that does not change; employees could go directly to the location, retrieve the resource and return to work. This would limit the amount of time employees spend searching for resources needed.

For example: in the current layout a single pan of salt is moved throughout the kitchen based on the employees' needs. Several pans of salt could be placed at different locations so that employees would not have to walk to one, centralized location. Alternately, the single pan of salt could be assigned a specific location within the kitchen to limit the amount of time employees spend looking for the pan. A further description of the implications of product location is found in the next section, product rehandling.

A more holistic solution for excessive walking would be to redesign and renovate the kitchen to better fit the needs of the hotel. For example, the kitchen needs to accommodate for the influx of guests during the busy season but also to allow for a smaller staff to successfully manage the kitchen during slower periods. This solution is expensive and time-consuming,

therefore the researcher proposes that the short-term solution of reorganizing as many elements as possible within the existing kitchen layout may be the first logical step.

Product Rehandling

Based on the results from this study, the researcher suggests that the behavior mapping tool might not be the best for identifying the productivity hindrance of product rehandling. The researcher observed that certain products or resources were frequently moved from one part of the kitchen to the other, causing employees to spend time searching for what was needed to complete a task. As a result, time and energy were wasted and employee behaviors suggested that they experienced frustration or anger. When employees became demonstrably frustrated, the researcher noticed an increase in the hesitation behavior.

The researcher suggests that data could be collected from semi-structured one-on-one or small group interviews to discover sources of frustration for employees and additional observational data could further uncover the negative consequences of frustration on productivity. In the following sections, the researcher outlines several products that are handled more frequently than necessary during a task.

Observation: The plastic wrap battle. One example of product rehandling is a large box of plastic wrap that all the employees used to wrap excess food, seal pots, pans, and platters of cooked food, and rewrap products. Although several open boxes were available in the kitchen, the employees were constantly taking the boxes from one another to have one on hand in their section of the kitchen. On June 18, the researcher observed the prep kitchen between the hours of 8:05 am- 2:02 pm. Figure 34, below, shows the placement of the prep kitchen in relation to the rest of the kitchen.

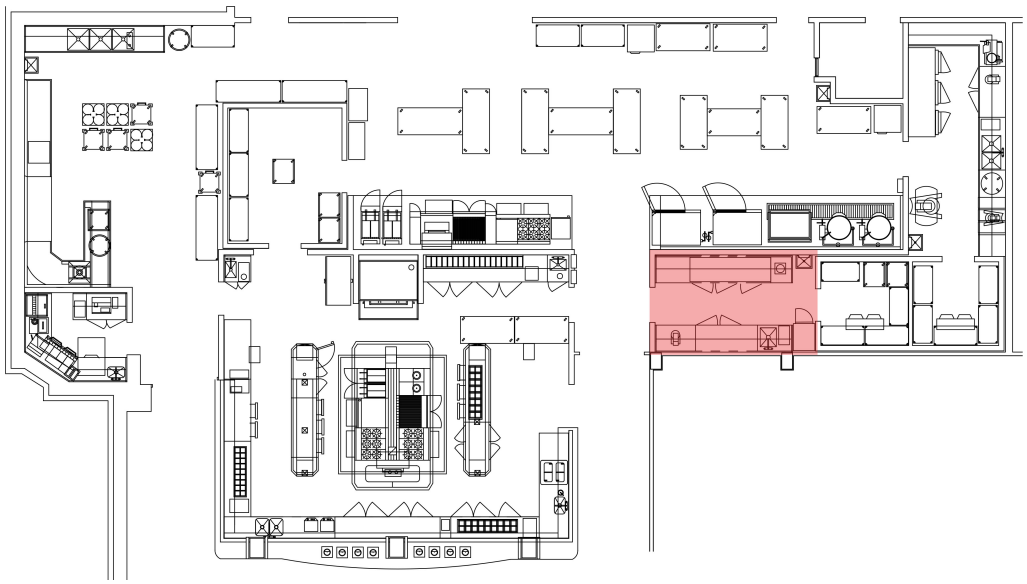


Figure 34: Location of prep kitchen in relation to the kitchen as a whole

During this time, the researcher observed an encounter with two employees and the box of plastic wrap. One cook was working in the prep kitchen completing tasks in relation to lunch service. The cook kept the plastic wrap box on the counter and used it periodically to wrap different dishes and plates and pans of food (Appendix T, 9:22-9:30 am shows an example of this process observed and recorded). During the 10:02-10:10 am time slot (Appendix U), an employee working in another part of the kitchen entered the prep kitchen and used the plastic wrap. The employee did not move the plastic wrap. Two employees entered and repeated the plastic wrapping process during the 10:22-10:33 am time slot (Appendix V). During the same time period, an employee entered the prep kitchen, took the box of plastic wrap, and exited while the cook was away from the prep kitchen. When the cook returned and noticed the plastic wrap gone, the cook began to complain about how the other employees do not respect the use of resources. The cook left and returned with a new box of plastic wrap, opened it, and placed it on the counter to continue wrapping serving bowls. During the 10:57-11:13 am time period (Appendix W), while the cook was again out of the room, another employee came in and took

the new box of plastic wrap.

Other resources that were taken from other employees include jugs of oil, bottles of wine, and salt and pepper. These resources seem to be stored in large containers that move around the kitchen to be shared by employees. As previously stated in the section on excessive walking, an alternative would be to have smaller containers at multiple locations. Behavior mapping may not be the most effective method for recording the problem of product sharing and rehandling; the researcher suggests that it might be possible to attach a device to these key products and track their travel around the kitchen. The data retrieved from these devices would give the researcher more accurate data on how often these products move and where they are used.

Observation: Front of house dirty dishes. The most frequent problems with product rehandling occurred during observation times in the dish pit. Figure 35, below, shows the dish pit in relation to the kitchen as a whole.

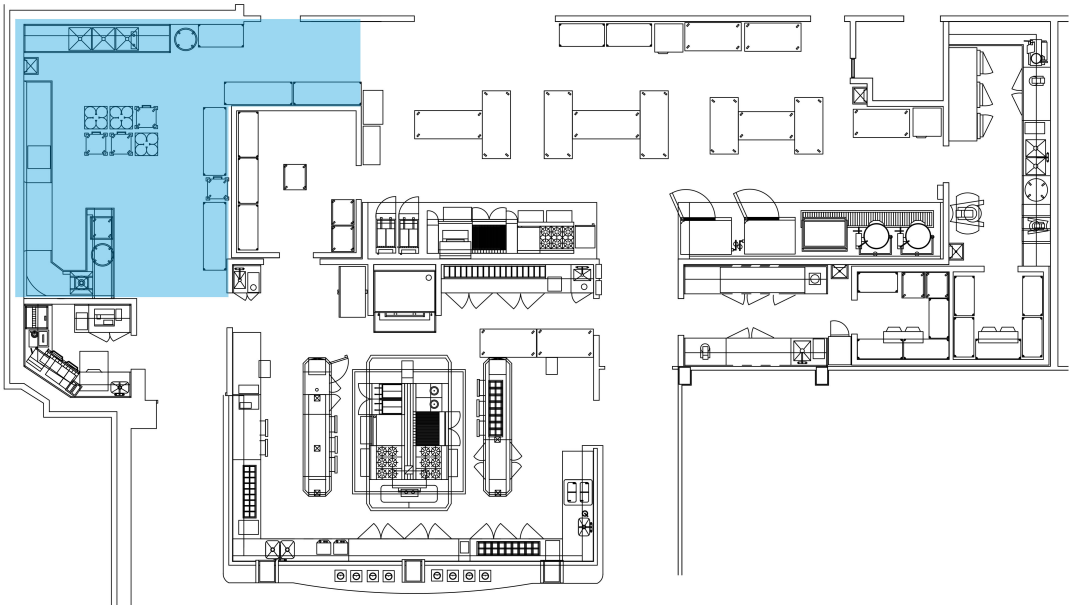


Figure 35: Location of dish pit in relation to the kitchen as a whole

The researcher observed this area three times: during breakfast (June 14 from 8:20-10:19 am), lunch (June 17 from 11:00 am-2:00 pm) and dinner service (June 18 from 6:00-8:01 pm).

During the course of the observations the researcher determined the dish pit was chaotic and a site of consistent issues and frustrations among employees. The researcher observed that the dish pit is used by the entire staff, front and back of house, but is not flexible in accommodating different staff needs. As a result, the dish pit is the source of multiple productivity hindrances related to product rehandling.

Observation revealed that there does not seem to be a standard system or process established in the dish pit area. The researcher observed three different processes during the three different observation times. For example, the dishwasher machine and adjacent shelves have labels and tubs to identify where specific dirty dishes are to be placed, such as plates, bowls, dessert plates, cups, mugs, and wine glasses. Behavior observations suggest that front of house employees do not abide by the labels. The researcher observed that the labels may not be placed in the optimum location for the stewards who work in the dish pit because the stewards were often observed redirecting servers to an area different from the one labeled (See Appendix X, June 18 from 6:44-6:56 pm). Some front of house employees dropped dirty dishes in the area specified by the label, perhaps because they missed the verbal directions given by the steward. The researcher observed that the stewards frequently expressed frustration at the front of house employees for their apparent disorganization when depositing dirty dishes into the dish pit. The researcher's observations suggest that there is no standard system in place. Therefore, neither the front of house employees nor the stewards are the source of the dish pit problem. Each steward's behaviors suggested they attempted to create a personal system during the shift, but the front of house employees were unable to learn and maintain a different system for each steward.

The researcher believes that the data collected is not sufficient to propose a specific solution and suggests that detailed observations be conducted in the dish pit, using both place-

centered and people-centered behavior mapping. In particular, the researcher proposes that a waste reduction study would be beneficial for the dish pit area. There may be enough space in the dish pit to accommodate the needs of the entire hotel if a universal system of organization were to be implemented.

Observation: Entrée Plates; clean and dirty. The hotel kitchen uses all kinds of serving dishes and utensils, ranging from plates of all sizes, cups of all types, saucers, silverware, baskets, and bowls of all sizes and types. The following observation pertains to the standard-size dinner plate that most entrées are served upon, especially in the banquet areas. In the dish pit, these plates do not seem to have a standard location. Some of them sit on shelves; some are stacked in rolling carts. An example is shown in Appendix Y and was observed on June 14 from 8:20-8:37 am. Figure 36, below, identifies the four areas that will be discussed in this section.

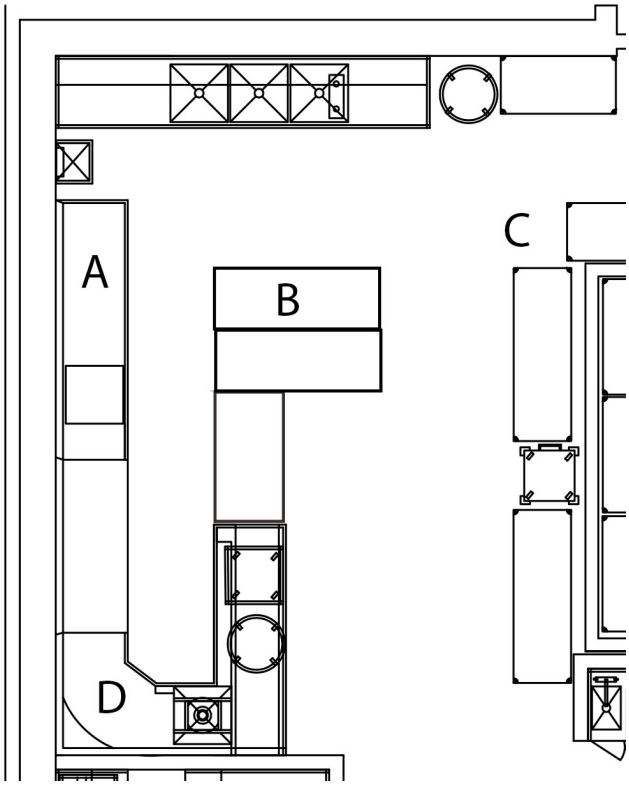


Figure 36: Identified areas in the dish pit

In (A), the steward unloads clean entrée plates from the racks that run through the dishwasher machine and places them in a stack. After the rack is emptied, the steward takes the stack of entrée plates and puts them on a shelf (B). The steward returns to unload a new rack of clean entrée plates (A). The steward carries the stack of plates from (B) to a plate cart on wheels, located in area (C). The steward returns to (A) and unloads a rack of clean plates and stacks them. After the rack is unloaded, the steward carries the stack of plates to (B). In this process, there is no designated place for the entrée plates; clean plates go to multiple areas to be stored. The cart the steward loaded the plates onto could be an appropriate place to store all the plates. The data gained from observations does not make it clear why the steward did not wheel the cart from area (C) over to area (A) and load the plates directly, instead of stacking them first and then carrying the stack to the cart. The researcher suggests that one possible solution would be to purchase and make available more of these plate carts as a standardized storage place for entrée plates.

Another steward used the plate carts on June 17. The researcher observed the following behaviors involving entrée plates on June 17th. Area (B) was loaded with dirty entrée plates. Between 11:24-11:33 am (Appendix Z), the researcher observed the steward going from area (B) to area (D) with these dirty plates a total of six times. In the 11:46-11:57 am (Appendix AA) time frame, the researcher observed the steward unloading the racks that had just come through the dishwasher machine in area (A). The steward pulled the entrée plates out of these racks and stacked them immediately into an entrée plate cart that the steward had moved into area (A). This observation suggests that the stewards do in fact use these carts, but not consistently. The researcher was unable to determine conclusively why the plate carts are not used on a more consistent basis. Possible reasons may include that there is not enough room to store the carts

once they are loaded or that there aren't enough carts to hold all the entrée plates. The researcher suggests one possible solution: after scraping plates clean from the conference room events, the servers could place them onto the entrée plate carts, instead of on the shelf in area (B). This would allow the steward to wheel the cart over the area (D) and load the plates directly into the cleaning racks for the dishwasher machine. The carts could then be washed after the dirty plates are emptied, and the same carts could be used to stack the clean dishes from area (A).

Summary of Product Rehandling. Product rehandling is a hindrance to productivity in a commercial kitchen because time and energy are wasted and, in the example of this kitchen, frustrations and tempers escalate when employees have to track down resources or learn new methods during each shift. Although the researcher recorded some circumstances of product rehandling during observations, the researcher concludes that this tool may not be the most effective at recording product rehandling because it returns insufficient data for forming recommendations. A suggestion for further researcher would be the creation of a system for tracking products as they move around the kitchen. If a semi-structured one-on-one or small group interview process is part of future studies, a suggestion would be to add questions about specific resources. For example, the types of questions asked about the plastic wrap problem could include:

- How do you feel when you have to look for plastic wrap?
- What do you think of the plastic wrap being in a centralized location?
- What are some benefits if a plastic wrap is location in your station?

These are questions that cannot be written until after the researcher has become familiar with the kitchen, the employees, and the products and resources that are rehandled. Therefore, behavior mapping may be of use as a preliminary tool to identify what types of questions should

be asked in a secondary stage of interviews. In the plastic wrap example, one solution may be for the plastic wrap to be mounted to the wall in a location the employees remember. However, having the resource in one centralized location may lead to excessive walking or cross traffic/confusion. It is therefore important to understand each of these productivity hindrances and their interrelationships before pursuing any single solution. The next section discusses cross traffic/confusion as a hindrance of productivity.

Cross Traffic/Confusion

The problem with cross traffic/confusion is that "employees bump into one another or are forced to wait while someone comes through or across their line of traffic" (Kahrl, 1975, pg.140). As soon as two employees bump into one another, this physical location is considered a point of collision. A point of collision is defined by the researcher as a point at which two or more employees bump into one another. The more employee traffic patterns cross each other, the more potential there is for these employees to bump into one another. Behavior mapping concludes that cross traffic/confusion results in points of collision. Completely eliminating cross traffic/confusion is not possible, but careful planning can be conducted to insure minimal cross traffic/confusion in a facility (Kahrl, 1975), thereby eliminating as many points of collision as possible.

Having worked in the foodservice industry for eight years, the researcher anticipated that cross traffic/confusion would be the greatest issue in the kitchen. Contrary to expectations, the researcher observed that the employees in this kitchen hardly run into each other. The employee paper-based surveys and behavior maps revealed little information about excessive walking and product rehandling. However, the surveys were helpful in identifying certain points of collision. Employees were asked to place a star on the base map to indicate an area where they run into

other employees. Figure 37, below, shows an employee behavior map with the stars placed where they run into other employees.

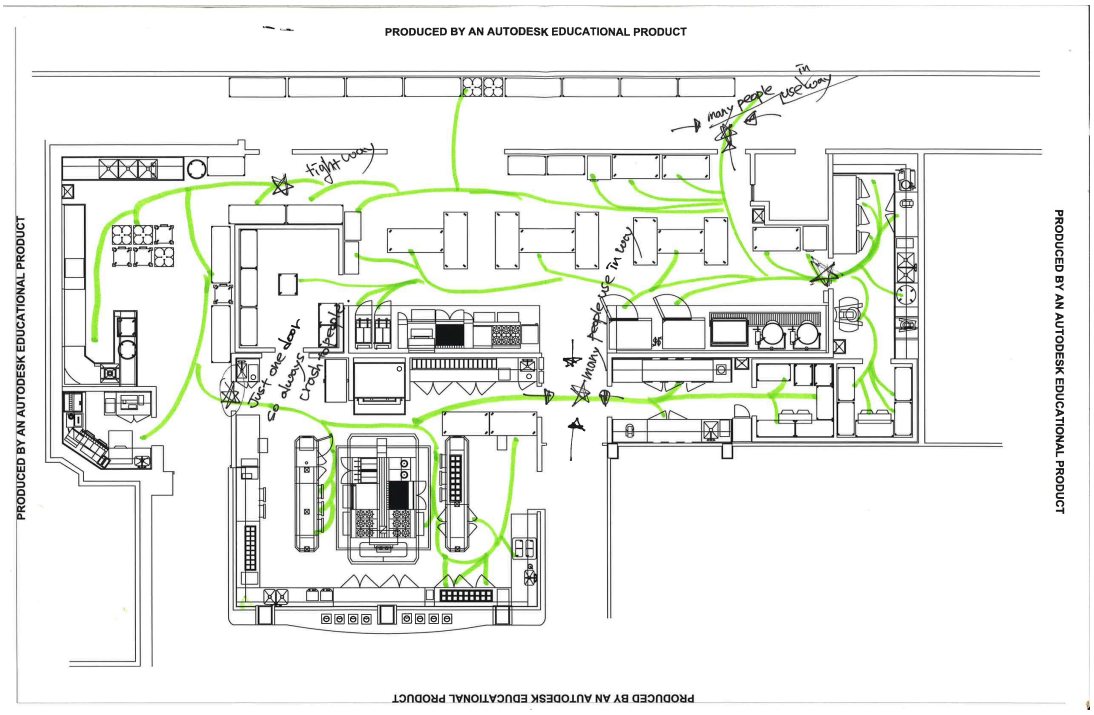


Figure 37: Self-reported behavior map with points of collision identified

These points of collision identified by the employees will be discussed throughout the following section. Some of the areas identified by the employees as areas where they run into one another were not recorded on the researcher's behavior maps. Based on observational data, these points of collision identified by the employees may not have a significant, negative impact on the employees' workflow. The data gathered in behavior mapping suggests that excessive walking hinders productivity in this kitchen. The survey responses and behavior maps both suggest that this kitchen may be too large for the daily tasks conducted. The kitchen's size may explain why employees do not often run into each other. Even in moments of high activity, very few collision instances were observed. Although collisions were limited, the researcher did gain knowledge of these points of collision from the survey data in the self-reported behavior

mapping, as well as from researcher-conducted behavior mapping. These points of collision, and how they were identified, are described in the following examples.

Observation: Hallway. The data gathered from the researcher's observations are consistent with the self-reported employee behavior maps in identifying the hallway as a major point of collision. Figure 38, below, identifies the location of the hallway in relation to the kitchen as a whole.

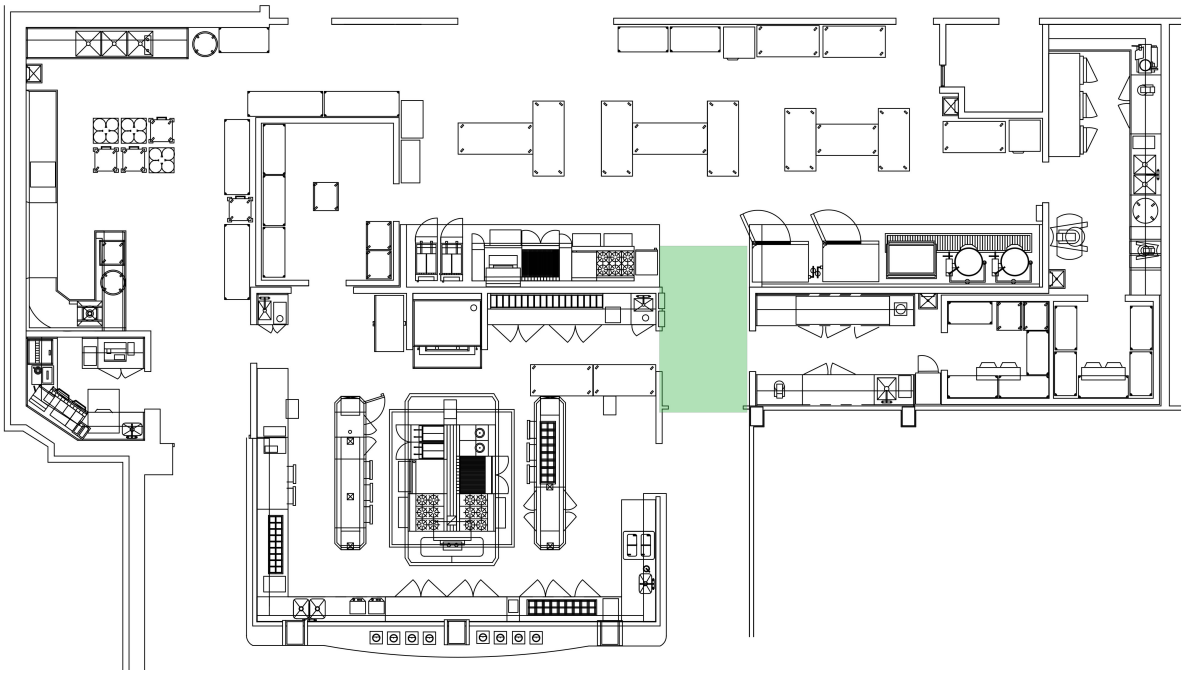


Figure 38: Location of the hallway in relation to the kitchen as a whole

The example employee self-reported behavior map (Figure 39, below) shows a collision in the hallway related to the hotbox. The hotbox stores plates to be used during service as well as an area to store hot food waiting to be served at the buffet during lunch.

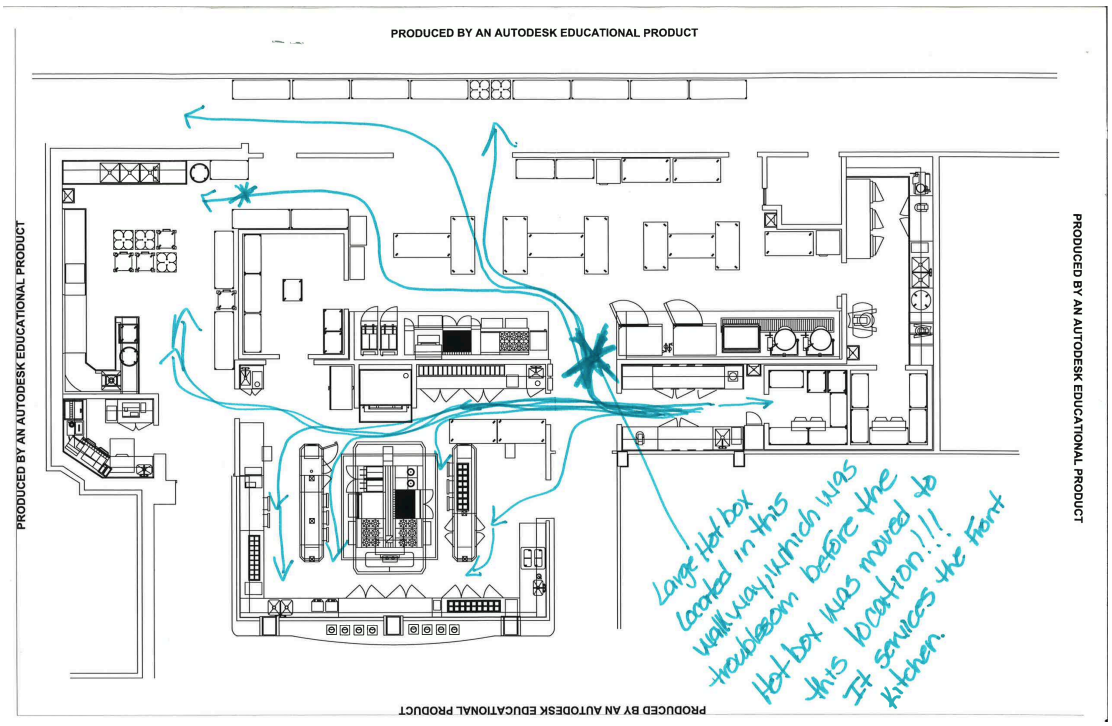


Figure 39: Self-reported behavior map identifying kitchen hallway as a point of collision

This hallway is located in the walk-through area from all back of house areas, including the banquet kitchen, to the prep and restaurant kitchens. Servers and management team members who are traveling in and out of the kitchen also use the hallway. The following photo (Figure 40) shows the placement of the hotbox in the hallway in relation to the double swinging doors that lead from the back of house to the front of house portion of the restaurant.

Figure 40: Photo of hotbox location in hallway

Behavior mapping data suggests that employees frequently access this hotbox and further that it is a leading cause of collisions between employees accessing the hotbox and those passing through the hallway. Thirteen of the 22 viable surveys collected identified this hallway as a major point of collision. Comments written on the behavior maps about the hallway include:

- Small walkway that makes the "in/out" doors useless since only one of the two can be used. Employees are constantly smashing into one another if not paying attention.
- Many people use it and the hot box is in the way
- Blind spot
- Hotbox in way of swinging doors. Impossible to cross with ease.
- This hallway was an issue before they moved the hot box into it, making it even more of a problem!
- Hotbox in the middle of this walkway

- Hotbox blocks walk through so only one person can pass at a time
- Collision point

The above responses also correlate to the data gathered through the researcher's behavior mapping observations. The hallway, particularly as a result of the location of the hotbox, is a point of collision. Therefore, the researcher suggests some design changes, beginning with relocation of the hotbox. One of the employee survey behavior maps indicated that the hotbox used to be located inside the restaurant kitchen and was moved to make more room in the kitchen. The researcher suggests moving the hotbox back into the restaurant kitchen.

Proposed solution: Hallway. Figure 41, below, identifies the new location of the hotbox, proposed by the researcher.

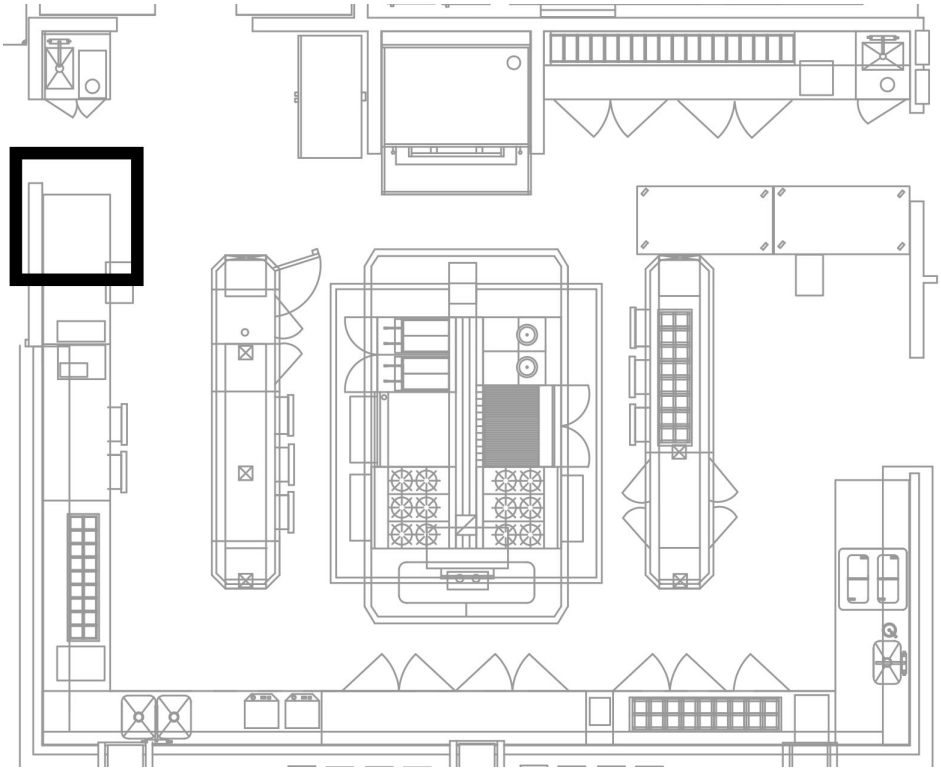


Figure 41: New location for hotbox in restaurant kitchen

The proposed location is currently home to a built in stainless steel cabinet with counter that abuts a structural column. The structural column interrupts the counter workspace for the

salad station, making it difficult to access one section of the counter without walking around the column (see Figure 42, below).

Figure 42: Photo of restaurant kitchen structural column

Observational data from the restaurant kitchen indicates that this part of the counter and cabinet are only used as a place to set boxes as they are brought into the kitchen. Therefore, the researcher suggests that the unused portion of the stainless steel cabinet and counter be removed to make room for the hotbox. This proposed location will not block existing lines of sight into the restaurant kitchen and will position the hotbox closer to the dish pit. As a result, the steward may be better able to unload clean entrée plates from the dishwasher machine and load them into the hotbox for storage. In addition to potentially decreasing cross traffic/confusion in the hallway and limiting the amount of collisions that occur, this move would also decrease excessive walking.

The second suggestion for the hallway is the installation of corner mirrors to allow an employee to see who is coming from either direction as they approach the hallway. This could

decrease collisions resulting from visibility issues. Being aware of others coming from opposite directions would give employees the opportunity to be vocal and communicate their arrival into the hallway and potentially avoid collisions with one another. Another source of cross traffic/confusion is described in the next section.

Observation: Banquet kitchen ovens. Right around the corner from the hallway, inside the banquet kitchen, are two large standing ovens. These ovens are identified in Figure 43, and the ovens can be seen in Figure 44 on the right side of the photo.

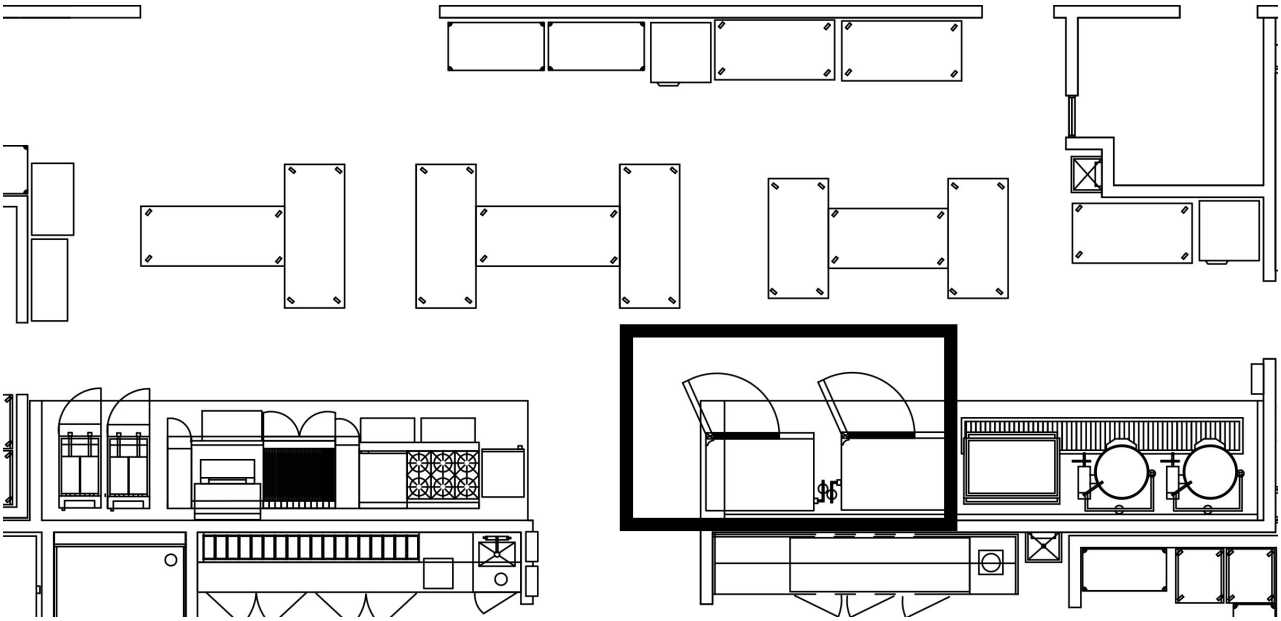


Figure 43: Location of ovens in banquet kitchen

Figure 44: Photo of banquet kitchen ovens, on the right

These ovens are used by almost all employees, including cooks who work in the banquet kitchen, the bakery, the restaurant kitchen, and the prep kitchen. The researcher observed several collisions occurring in the area in front of the ovens. One example of a collision is shown in Appendix BB during June 16 in the 10:15-10:23 am time frame. At the time the collision occurred, one employee was walking through the banquet kitchen and the other employee was unloading a pan from the oven to the prep table behind the oven. This same behavior occurred again the same day when one employee was pulling a large pan of meat out of the oven and placed it on the prep table (June 16 from 10:51-10:58 am, Appendix CC). One employee behavior map identified this area in front of the ovens as a "tight squeeze," and this area was identified in three employee behavior maps as a place where the employees run into one another.

Collisions can be especially hazardous in a kitchen environment in which employees may be carrying hot pans, knives, or other hazards. The more frequently collisions occur the more likely one of these behaviors might result in a burn or other personal injury. The researcher

suggests providing a cart on wheels near the ovens. Rather than rotating 180 degrees to place the food on a prep table, an employee could move the cart close to the ovens to assist in loading and unloading food. The previous two examples were from the banquet kitchen; the next example explores the problem of cross traffic in the restaurant kitchen.

Observation: Restaurant Kitchen. Researcher-acquired behavior mapping data suggests that cross traffic/confusion rarely occurs in the restaurant kitchen. In other words, few collisions were observed. In comparing this data with employee behavior maps, however, the researcher suggests that additional observations need to be conducted to focus on areas identified by employees as points of collision. One of the places identified by the employees as a point of collision is in front of the pizza oven. The pizza oven is indicated in Figure 45, below.

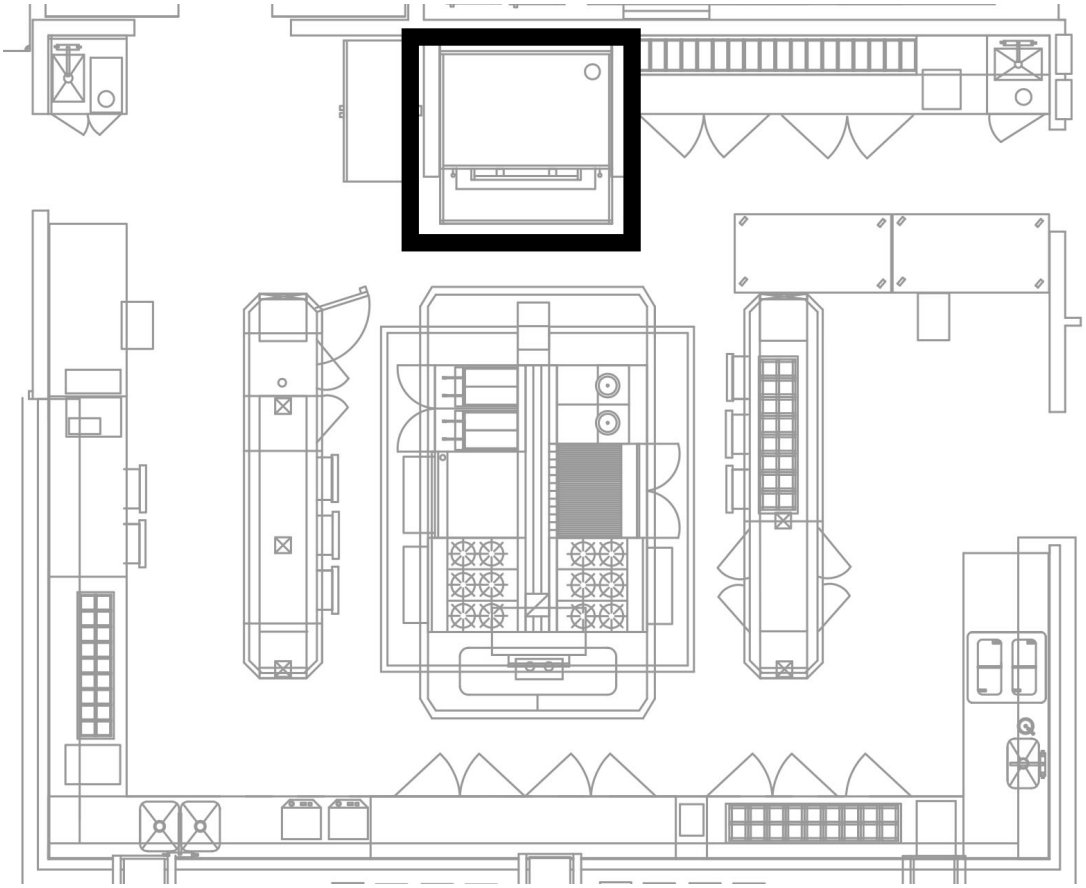


Figure 45: Location of pizza over in restaurant kitchen

Not only did employees indicate this area as a point of collision, but one employee labeled this area a “tight squeeze” on their behavior map. Collisions occurred twice in front of this oven, as recorded by the researcher (Appendix DD, June 13 from 12:38-12:44 pm and Appendix EE, June 19 from 7:30-7:40 am). Behavior mapping suggests that this is a point of collision, but additional observations focused on this area would assist in identifying the underlying causes of the problem.

The areas identified in Figure 46, below, show points of collision as indicated in the behavior mapping portion of the employee survey.

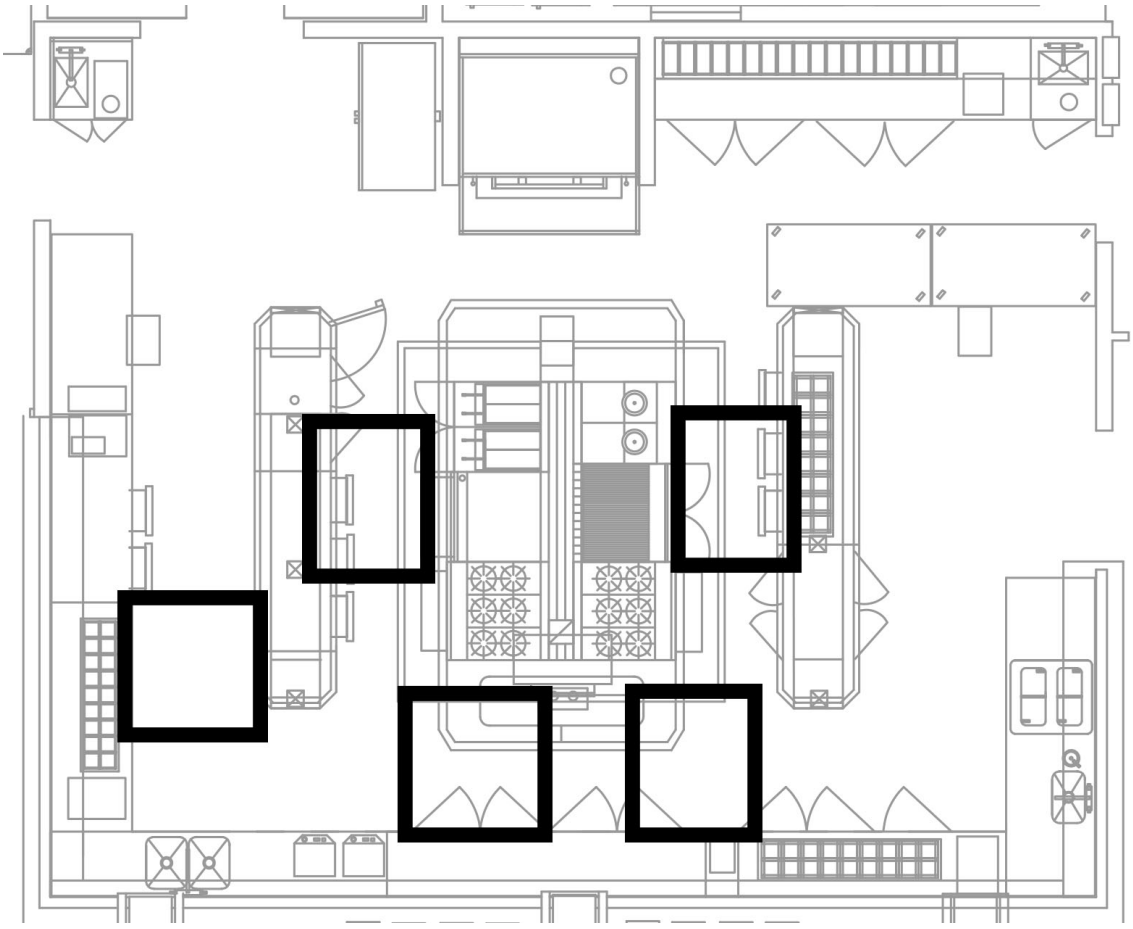


Figure 46: Location of areas employees identified through self-reported behavior mapping as points of collision

The researcher’s behavior maps were not consistent with the employee self-reported

behavior maps for these areas. The researcher observed this area a combined total of 17.5 hours during breakfast, lunch, and dinner. The researcher never observed the areas identified by the employees in the figure above as points of collision. Because the employees' behavior maps are inconsistent with the researcher's behavior maps, the researcher proposes that when identifying productivity hindrances in a hotel kitchen, employee surveys alone may not be a sufficient tool for determining the problem areas. The researcher suggests that additional observations need to be conducted to conclude whether or not these areas are in fact points of collision before design changes are considered.

Summary of Cross Traffic/Confusion. Although the employee behavior maps were helpful in identifying the points of collision, the maps gave little data about why the employees were running into each other at these specific points. The researcher suggests that in further studies conducted to measure cross traffic/confusion, the researcher collects employee self-reported behavior maps from the employees prior to observations. This would allow the researcher to conduct focused observations on the areas identified by employees as points of collision in addition to general observations of the whole space.

The researcher further suggests that future studies conducted in this particular kitchen include observations of the transitional area between the dish pit and banquet kitchen. This transitional area was identified as a point of collision in several of the employee behavior maps. The observations of these collision points should include greater detail, such as the number of people involved in the collision, whether the employees made physical contact, what the employees were carrying, and what occurred immediately following the collision. For example:

- At an identified point of collision, how many collisions occurred over the course of a certain time frame?

- How many employees were involved during each collision?
- From which directions were the employee coming and going during the time of the collision?
- Were the employees carrying anything? If so, what were they carrying?
- What were the behaviors of each employee immediately following the collision?

Thinking of these questions when observing points of collision will help collect data that could potentially lead to discoveries as to why employees collide and what could be done to prevent these collisions.

Conclusion

After 60 hours of place-centered behavior mapping over the course of an eleven-day period from June 10-June 20, 2013, the researcher was able to analyze and draw conclusions from the data collected from researcher behavior maps and paper-based employee surveys that included self-reported behavior maps.

Although little was discovered with the use of the paper-based surveys and self-reported behavior maps, the researcher's behavior maps were effective in revealing certain patterns of behavior and hindrances to productivity. The results of this study reveal several trends that correlate with the literature. The researcher concludes that using self-reported behavior mapping may be a useful tool in conjunction with researcher-conducted behavior mapping when the self-reported maps are completed prior to researcher's behavior maps. If this step occurs before the start of observations, the researcher will have a better indication of which areas may require additional behavior mapping. Bias could result from the researcher reviewing employee self-reported behavior maps prior to any completed observations, however. To decrease the impact of this bias, the researcher could conduct an initial behavior mapping process for the space, review

self-reported behavior maps, and then complete the observation process with a focus on employee-identified problem areas. The researcher suggests that a combination of employee experience and researcher expertise may be the best way to develop conclusions for the productivity hindrances in a full-service hotel kitchen.

Excessive walking was identified as a problem by both behavior mapping and survey data. Because employees are not producing when they are walking, excessive walking leads to a decrease in productivity. Therefore, any extra walking done by employees should be eliminated. Survey data suggests that employees may be aware that they walk a lot but may not be able to identify solutions to their excessive walking. The trend of excessive walking was observed in three major places: the sink in the banquet kitchen, the pizza oven in the restaurant kitchen, and the bakery. Overall, the researcher observed the employees engaged in the behavior of "hesitates" on a regular basis throughout the observed areas.

The trend of product rehandling was observed involving plastic wrap used by the cooks, as well as in two major instances involving both clean and dirty plates in the dish pit and in other zones throughout the kitchen. Although the researcher recorded some circumstances of product rehandling during observations, the researcher suggests that this tool may not be the optimum method by which to collect data related to product rehandling. The researcher makes the suggestion that another tool may be used in conjunction with the behavior mapping method in order to accurately identify issues of product rehandling.

Although very little about excessive walking and product rehandling was found in the employee surveys, the employee behavior maps were helpful in identifying certain zones where the trend of cross traffic/confusion occur. There were three major areas of cross traffic/confusion identified through observations and employee self-reported behavior maps that resulted in points

of collision: the hallway in the transition area between the banquet kitchen and the restaurant and prep kitchens, the area in front of the banquet kitchen ovens, and the restaurant kitchen as a whole. Although this research identified points of collision in this kitchen, additional development of this research tool could provide more information on the productivity hindrance of cross traffic/confusion in the future. Acquisition of employee knowledge ahead of time would enable the researcher to make a pre-study decision about where to stand to conduct observations. This could provide the researcher with place-centered behavior maps that focus on potential problem areas within the kitchen in order to develop solutions for these areas.

The trends of excessive walking, product rehandling, and cross traffic/confusion were identified through observations conducted by the researcher. Analysis of the researcher's behavior maps and employee self-reported behavior maps reveal these trends as problem areas in a full-service hotel kitchen.

Discussion

Research Questions Answered

The researcher's overarching question was: How can interior design research use behavior mapping to help the foodservice industry improve the bottom line? The researcher sought to answer the following research questions in this manuscript. In this section, the researcher will summarize the answers to these questions using the data collected in the study.

RQ1 (A): Can the productivity hindrance of excessive walking (Kahrl, 1975) be observed through researcher-conducted behavior mapping in a full-service hotel kitchen?

YES. The productivity hindrance of excessive walking was observed through researcher-conducted behavior mapping.

RQ1 (B): Can the productivity hindrance of excessive walking (Kahrl, 1975) be observed

through employee self-reported behavior mapping in a full-service hotel kitchen?

YES. The self-reported behavior mapping portion provided some data that could be interpreted as an indication of excessive walking. However, employee feedback provided via the paper-based survey did not specifically indicate excessive walking.

RQ2 (A): Can the productivity hindrance of product rehandling (Kahrl, 1975) be observed through researcher-conducted behavior mapping in a full-service hotel kitchen?

YES. Researcher-conducted behavior mapping identified the hindrance of product rehandling but the research tool may not be the most informative way to identify this productivity hindrance.

RQ2 (B): Can the productivity hindrance of product rehandling (Kahrl, 1975) be observed through employee self-reported behavior mapping in a full-service hotel kitchen?

NO. Product rehandling was not observed in employee self-reported behavior maps.

RQ3 (A): Can the productivity hindrance of cross traffic/confusion (Kahrl, 1975) be observed through researcher-conducted behavior mapping in a full-service hotel kitchen?

YES. The productivity hindrance of cross traffic/confusion was observed using researcher-conducted behavior mapping.

RQ3 (B): Can the productivity hindrance of cross traffic/confusion (Kahrl, 1975) be observed through employee self-reported behavior mapping in a full-service hotel kitchen?

YES. Self-reported behavior mapping resulted in the identification of the productivity hindrance of cross traffic/confusion.

RQ4: Does a paper-based survey combined with behavior mapping method result in more descriptive behavior findings than the survey method alone?

YES. The combination of both researcher-conducted and self-reported behavior mapping

resulted in more descriptive findings on employee behavior than a survey method alone.

In the following section, the researcher critiques the research tool used in this study. The researcher goes into detail about the aspects of the paper-based survey that were successful and the ones that could use improvement. The researcher also discusses both researcher-conducted and self-reported behavior mapping and the potential changes that could be made to improve those tools.

Critical Analysis of Research Tool

In the results, the researcher identified the following hindrances of productivity:

1. Excessive walking
2. Product rehandling
3. Cross traffic/confusion (Kahrl, 1975)

These hindrances, suggested by the literature, were further supported by data gathered through researcher-led behavior mapping and employee surveys that included self-reported behavior mapping.

The purpose of this study was to test a research tool that could be used to identify these hindrances in a full-service hotel kitchen. The further purpose of the findings would be to enable upper management to produce solutions that streamline workflow processes through improved spatial layout and functionality and the development of a more productive physical environment. A more productive physical environment can improve working conditions and thereby increase employee satisfaction and decrease employee turnover, ultimately improving the bottom line. In the following section, the researcher will analyze the efficacy of the method and tools used in the study.

Pre-study preparation. Before conducting the study, the researcher had an initial meeting

with the general manager of the hotel. The researcher expressed the ideas and goals of the study and asked the general manager's opinion about whether the employees would be receptive to the study and also whether a study of this kind would be beneficial to the hotel. The general manager stated that the employees were used to having students participating in various behaviors in the kitchen and therefore the researcher's presence in the kitchen would be well received. If this study is conducted in the future in a hotel not directly connected to a university, researchers may be presented with additional challenges not faced in this scenario.

The general manager informed the researcher that although the study would be interesting, the data gathered might or might not be useful to the hotel. The management staff was busy, and making contact with them was challenging. After permission had been granted, management expressed a desire to stay informed with what was occurring throughout the study but chose not to be included in every decision about the process. The best way to communicate with management at this hotel was through direct, concise emails sent to all people involved.

In addition to the general manager meeting, the researcher set up a meeting with the hotel kitchen management team. This team, at the time, consisted of an executive chef and two executive sous chefs. The meeting was scheduled for a specific time, and all three members had acknowledged they would attend. At the meeting, however, only one of the team members was present because of conflicting events occurring in the kitchen. Future researchers can anticipate an extreme need for flexibility with hotel staff.

Researchers should also be prepared for high turnover rates when communicating with employees. For example, the executive sous chef that met with the researcher for this initial meeting was no longer employed at the restaurant by the time the researcher started observations a month later. The researcher was never notified the chef was no longer an employee and did not

find out the chef had left until several days into the observations.

Paper-based survey. The survey did not produce a high response rate, and those employees who responded did not necessarily provide the kind of information that was useful to the researcher. Because little data was collected from the paper-based surveys, it is possible that the system of distributing the survey was not a very appropriate one. Of the 43 survey packets distributed by the researcher, 16 packets were not picked up at all by the employee; 3 packets were picked up but not retuned; and 24 packets were returned, although two responses were thrown out for incomplete or missing data. Of the 43 survey packets distributed, the researcher collected 22 useable surveys with a response rate of 51%. There are several possible reasons why there was not a higher participation rate. One reason may have been the fact that some employees did not work on a set, standard schedule in the kitchen. In this kitchen environment, there was no daily meeting with employees. Further, employees were provided with little direction on what their tasks would be; their only direction was provided through the daily menu posted to a bulletin board. The researcher also encountered employees who did not speak English sufficiently to participate in the research process.

The researcher's experience before and after scheduled behavior mapping sessions suggests that informal conversations with employees coupled with casual observations may be more productive in soliciting employee input about the space and the work done in it. From the researcher's experience, it seemed that the more the employees became familiar with the researcher's presence the more they were willing to discuss their workspace. The researcher's eight years of experience as a food and beverage worker was useful because the researcher was familiar with the industry culture and may have thus been better able to engage with employees.

The researcher suggests that one-on-one or small group semi-structured interviews may be

a better approach than paper-based surveys and that such interviews should be conducted at intervals throughout the observation process. The researcher suggests two stages of semi-structured interviews. The first stage would occur during the introductory meeting with the staff. The researcher suggests that any management present leave the room and the researcher get to know each employee. Appendix L provides examples of an introduction for the researcher and questions that could be asked during this step of interviews. Part two of interviews would be a more detailed interview process in which the researcher works with individual employees or different employee groups. Appendix M contains questions that could be asked during this stage of interviews.

Behavior mapping and observations. The researcher and two professors, at the start of the observations, conducted an hour-long trial run of the behavior mapping method. The researcher originally planned to have 11x17-in. maps of the kitchen as well as 8.5x11-in. charts to record behaviors, but this plan proved inefficient because the researcher did not have a writing surface and had to maintain all of the pieces of paper on one clipboard while standing. After the first hour of observation the researcher determined that using colored pens to record the separate movements of the employees would be more beneficial than trying to use one color for all employees. The researcher also discarded the chart system in favor of writing notes directly on the behavior maps for efficiency. The researcher also discovered that there was no space in the kitchen in which to store the researcher's personal bag that held additional charts and pens. The researcher was required to limit personal belongings to what could be carried in the pockets of a chef coat or in hand: a clipboard with behavior maps of only the area of the kitchen being observed, colored pens, cell phone to keep time, and a single car key. Future researchers should be prepared to dress as employees dress—typically black pants, black shoes, chef coat and head

covering—and to limit what they bring to the site to what can be carried in their pockets or hands.

The ability to write quickly and efficiently is vital in conducting observations of a fast-paced environment. The researcher suggests that it is necessary to use a shorthand system for behavior mapping to record accurate and complete data. Appendix N shows a list of shorthand terms for behaviors the researcher created to use with future studies. Shorthand has some limitations in that the researcher may be the only one who can decipher the behavior maps.

The researcher also suggests that observation sheets be recorded in very brief time increments. For example, a new behavior map could be created every five minutes. Having a clock that attaches to the researcher's clipboard may be a convenient way to check the time quickly in an attempt to maintain accuracy. This method allows another layer of data to be collected, that is data related to when activity increases and decreases. This layer of data becomes increasingly more accurate as the time frame of each observation decreases. For example, five-minute maps are more accurate than ten-minute maps. Frequently changing to new maps also assists in keeping annotations clear and understandable in the fast-paced environment of a full-service hotel kitchen.

The researcher suggests that an interview process with employees will be more informative than the paper-based survey process. A challenge for the researcher was the comfort level the employees felt with the researcher's presence. The incorporation of several stages of semi-structured interviews throughout the observation process enabled the employees to become more familiar with the researcher and to ask questions in an interactive way. The researcher suggests that semi-structured one-on-one or small group interviews would be better than a large-group interview. Not involving management during the interview process would allow a layer of

privacy to be achieved in hopes that the employees would be honest about their feelings regarding their physical environment. Most importantly during observations, the researcher needs to be self-sufficient and able to move around when necessary. Nothing deterred the employee's from cooperating more than the employee being in the way when a task was being conducted. The following section goes into further detail on suggestions for future research.

Limitations

A limitation of the study was the inability to record all the behaviors performed by the employees owing to the fast paced environment of the foodservice kitchen. Since the researcher was collecting observations alone and the nature of the foodservice industry is intense, every behavior conducted by every employee could not be recorded. Suggestions to combat this limitation in the future include using multiple observers, breaking down kitchen zones into smaller areas for a single observer, or using cameras to observe the kitchen instead of an on-site observer. If a common procedure for observing is produced, multiple observers could conduct observations simultaneously. During such team observations, each observer could be assigned one or more employees in the area of observation. This would allow each observer to focus on detailed behaviors conducted by employees. If there is only a single observer, that person could focus on smaller portions of the kitchen and thereby be able to catch every behavior conducted in the space. If cameras are used, the researcher would be able to replay the film as many times as needed in order to identify patterns of behavior.

Another limitation in the present study is that the researcher has worked in the foodservice industry for eight years. This prior work experience could lead to biases in the research and data collection. To counteract this bias, the researcher conducted observations in an unfamiliar kitchen. The researcher also recorded only objective observations of behaviors being conducted

in the kitchen. Any time a subjective observation was recorded, the note was omitted from the results.

Suggestions for Future Research

The study at hand has provided a great deal of data as well as suggested opportunities for future research in this and other full-service commercial kitchens. For this specific hotel kitchen, further researcher could include a prep table study, resource sensors, pedometers, observations conducted in specific locations, and generalized behavior mapping using simultaneous observers.

In a prep table study, the researchers would focus on the prep tables located in the banquet kitchen. A wide variety of behaviors and tasks occur on and around the prep tables. Based on observational data, these eight prep tables are kept in formations of four work surfaces that change frequently to accommodate different tasks. There was not a time during behavior mapping when all of the prep tables were being used at once. A study that discovers the most useful arrangements of these prep tables, and the overall amount of workspace needed, would help management decide how large this preparation area needs to be in future renovations.

The researcher also suggests a future study that follows resources as they move to different places in the kitchen. Placing sensors on these frequently used products (such as the box of plastic wrap mentioned in the results section) would help to uncover how often products are moved and in what locations they spend the most time.

Pedometers—which roughly track the number of steps a person takes—could provide standards related to excessive walking. If pedometers were assigned to employees in various hotel kitchens, an average number of steps per shift could be determined. In turn, specific kitchens could measure their outcomes against this industry standard as another way to determine whether walking distances should be deemed excessive in a particular layout.

Conclusion

The researcher has outlined the negative impact employee turnover has on the foodservice industry. Job satisfaction is one of the important variables to take into consideration when studying employee turnover. There are many factors that contribute to job satisfaction for employees. Some examples of these factors include need for achievement, chance for advancement, compensation, creativity, and working conditions (Quinn & Staines, 1977). The literature shows that employees favor a safe and clean work environment as an example of what makes for good working conditions (Simons & Enz, 1995). The researcher has defined working conditions as the circumstances and characteristics of a job that positively or negatively affect an employee in the workplace, such as: wages, relationships with fellow employees, training offered by management, scheduling, uniform requirements, and the physical environment. Based on the review of literature, the researcher identified that effects of the physical environment on working conditions seems be under-studied in comparison with the other factors. The physical environment can be summarized in three categories of factors: ambient conditions, space/function (also known as spatial layout and functionality), and signs, symbols, and artifacts (Bitner, 1992).

This study focused on the environmental dimension of space/function because little published literature exists on this topic in the industry of foodservice. The researcher suggested three possible reasons for why so little research has been published about the environmental dimension of space/function:

- The components of spatial layout and functionality are not valued
- The components of spatial layout and functionality are valued but not studied
- The components of spatial layout and functionality are valued and studied but not

published

The researcher then concluded that the components of spatial layout and functionality are valued and studied, but not published.

The study at hand sought to demonstrate the value of spatial layout and functionality in the foodservice industry and the impact these components have on productivity, employee satisfaction, and ultimately the bottom line. This study introduced a method for additional research to be conducted in an attempt to limit the productivity hindrances of excessive walking, product rehandling, and cross traffic/confusion. This work further sought to explore behavior mapping as a research tool that can be used, by both interior designers and food service professionals alike, to establish a benchmark for observing and identifying key productivity hindrances of the physical environment in a full-service hotel kitchen.

The researcher concluded that the productivity hindrances of excessive walking, product rehandling, and cross traffic/confusion can be identified using the research tool of researcher-conducted behavior mapping. Although modifications to the tool may be valuable for future researchers, this tool has proven to be effective in identifying these three productivity hindrances. The data collected from the study indicates that self-reported behavior mapping could be used as a way to identify two of the three productivity hindrances: excessive walking and cross traffic/confusion. Data collected from the self-reported behavior maps did not identify the productivity hindrance of product rehandling. More descriptive behavior findings were uncovered using a combination of a paper-based survey and behavior mapping. These two tools together produced more detailed results about the productivity hindrances of full-service hotel kitchen employees. The information gathered in this study suggests that employee insight is helpful but incomplete unless supplemented with behavior mapping. The researcher therefore

proposes that the observation tool of behavior mapping in combination with employee feedback is a successful model for identifying what changes need to be made to a commercial kitchen space in regard to these three productivity hindrances. The researcher acknowledges that changing the behaviors of employees can be challenging, especially because the foodservice industry is a fast-paced environment in which ingrained behaviors typically overshadowed new recommended behaviors. This concept demonstrates the need for explorative, qualitative research in determining the best solutions for improving productivity in a full-service hotel kitchen. Standard, quantitative methods may not encompass the facets necessary to develop solutions. By using the qualitative research tool of behavior mapping, the researcher has added to the body of knowledge in spatial layout and functionality of a full-service hotel kitchen with results that can be used by both interior design and food service professionals.

References

Abbasi, S. M., & Hollman, K. W. (2000). Turnover: The real bottom line. *Public Personnel Management, 29*(3), 333-342. Retrieved from http://www.emeraldinsight.com/bibliographic_databases.htm?id=1290350&show=abstract

Atkinson, W. (October, 2002). Decreasing industry injury rates. *Restaurant and Institution, 112,* 80-82. Retrieved from http://www.highbeam.com/doc/1G1-92684142.html

Baxter, P. & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *The Qualitative Report, 13*(4), 544-559. Retrieved from http://www.nova.edu/ssss/QR/QR13-4/baxter.pdf

Ben-Abraham, R., Keller, N., Szold, O., Vardi, A., Weinberg, M., Barzilay, Z, & Paret, G. (2002). Do isolation rooms reduce the rate of nosocomial infections in the pediatric intensive care unit? *Journal of Critical Care, 17*(3), 176-180. doi: 10.1053/jcrc.2002.35809

Bitner, M. J. (1992) Servicescapes: The impact of physical surroundings on customers and employees. *Journal of Marketing, 56*. 57-71. doi: 10.2307/1252042

Bottom line. 2013. In Merriam-Webster.com. Retrieved from http://www.merriam-webster.com/dictionary/bottom%20line

Burgess, S. (1998). Analyzing firms, jobs, and turnover. *Monthly Labor Review, 121*(7), 55-57. Retrieved from http://connection.ebscohost.com/c/articles/8957263/analyzing-firms-jobs-turnover

Chiang, C. F., Back, K. J., & Canter, D. D. (2005). The impact of employee training on job satisfaction and intention to stay in the hotel industry. *Journal of Human Resources in Hospitality & Tourism, 4*(2), 99-118. doi: 10.1300/J171v04n02_06

Chiang, F. F.T., Birtch, T. A., & Kwan, H. K. (2010). The moderating roles of job control

and work-life balance practices on employee stress in the hotel and catering industry. *International Journal of Hospitality Management, 29*, 25-32. doi: 10.1016/j.ijhm.2009.04.005

Chow, A. J., Alonso, A. D., Douglas, A. C., & O'Neill, M. A. (2010). Exploring open kitchens' impact on restaurateurs' cleanliness perceptions. *Journal of Retail & Leisure Property, 9*(2), 93-104. doi: 10.1057/rlp.2009.26

Cocci, S. J., Namasivayam, K., & Bordi, P. (2005). An investigation of ergonomic design and productivity improvements in foodservice production tables. *Foodservice Research International, 16*, 53-59. doi: 10.1111/j.1745-4506.2005.00009.x

Cosco, N. G., Moore, R. C., & Islam, M. Z. (2010). Behavior mapping: A method for linking preschool physical activity and outdoor design. *Medicine & Science in Sports & Exercise, 42*(3), 513-519. doi: 10.1249/MSS.0b013e3181cea27a

Cotton, J. L., & Tuttle, J. M. (1986). Employee turnover: A meta-analysis and review with implications for research. *Academy of Management Review, 11*(1), 55-70. Retrieved from http://www.jstor.org/stable/258331

Davis, T. R. V. (1984). The influence of the physical environment in offices. *The Academy of Management Review, 9*(2), 271-283. doi: 10.2307/258331

Dermody, M. B. (2002). Recruitment and retention practices in independent and chain restaurants. *International Journal of Hospitality & Tourism Administration, 3*(1), 107-117. doi: 10.1300/J149v03n01_06

Dickinson, J., & McLain-Kark, J. (1996). Wandering behavior associated with Alzheimer's disease and related dementias: Implications for designers. *Journal of Interior Design, 22*(1), 32-38. doi: 10.1111/j.1939-1668.1996.tb00224.x

Dudley, S. K., & Carr, J. M. (2004). Parents staying with hospitalized children. *Journal of Pediatric Nursing, 19*(4), 267-275. doi: 10.1016/j.pedn.2004.05.008

Evidence-based Design Accreditation and Certification (EDAC). (2008). *An Introduction to evidence-based design: Exploring healthcare and design.* Concord, CA: The Center for Health Design.

Fournier, G. (2010). *Encyclopedia of Psychology.* Retrieved from http://psychcentral.com/encyclopedia/2009/naturalistic-observation/

Guerin, D. & Dohr, J. (n.d.). *Part III: Research methods.* Retrieved from http://www.informedesign.org/_doc/Research_101_Part_III.pdf

Hamilton, D. K., & Watkins, D. H. (2009). *Evidence-based design for multiple building types.* Hoboken, New Jersey: John Wiley & Sons.

Heyns, R. W., & Zander, A. F. (1953). Observation of group behavior. In L. Festinger & D. Katz, (Eds.), *Research methods in the behavioral sciences* (pp. 381-417). New York, NY: Dryden Press.

Hinkin, T. R., & Tracey, J. B. (2000). The cost of turnover: Putting a price on the learning curve. *Cornell Hotel and Restaurant Administration Quarterly, 41,* 14-21. doi: 10.1177/001088040004100313

International Building Code (IBC). (2012). *Occupancy classification of commercial kitchens. Section 303.3.* Retrieved from: http://media.iccsafe.org/news/eNews/2012v9n1/2012_ibc_sigchanges_pgs14-15.pdf

International Labour Conference (1990). *Working conditions in hotels, restaurants and similar establishments: Sixth item on the agenda.* Geneva, Switzerland: International Labour Office.

Jones, T., Strickfaden, M., & Kumar, S. (2005). Physical demands analysis of occupational tasks in neighborhood pubs. *Applied Ergonomics, 36*(5), 535-545. doi: 10.1016/j.apergo.2005.03.002

Kacmar, K. M., Andrews, M. C., Van Rooy, D. L., Steilberg, R., & Cerrone, S. (2006). Sure everyone can be replaced...but at what cost? Turnover as a predictor of unit level performance. *Academy of Management Journal*, *49*(1), 133-144. doi: 10.5465/AMJ.2006.20785670

Kahrl, W. L. (1975). *Food service productivity and profit ideabook*. Boston, MA: Cahners Publishing Company, Inc

Kazarian, E. A. (1975). *Food service facilities planning* (1st ed.). Westport, CT: Avi Publishing Company, Inc.:

Keil, C. B., Kassa, H., & Fent, K. (2004). Kitchen hood performance in food service operations. *Journal of Environmental Health, 67*(5), 25-30. Retrieved from: http://www.ncbi.nlm.nih.gov/pubmed/15628193

Knoll. (2010). A call center case study: The impact of workstation design and work tools on performance. Retrieved from http://www.knoll.com/media/74/722/CallCenterCaseStudy.pdf

Leaman, A. (1995). Dissatisfaction and office productivity. *Facilities, 13*(2), 13-19. doi: 10.1108/02632779510078120

Levin, D. (2011, April). The growing conversation around evidence-based design. *Healthcare Design Magazine, 11*(4), 8-9. Retrieved from http://www.healthcaredesignmagazine.com/article/growing-conversation-around-evidence-based-design

McCain, M. (2009). *Serving students: A survey of contracted food service work in New Jersey's K-12 public schools.* Retrieved from http://www.seiu.org/images/pdfs/seiuRutgersReport.pdf

Meyers-Levy, J., & Zhu, R. J. (2007). The influence of ceiling height: The effect of priming on the type of processing that people use. *Journal of Consumer Research, 34*(2). Retrieved from

Mill, R. C. (1989). *Managing for productivity in the hospitality industry*. New York, NY: Van Nostrand Reinhold.

Miller, R. H., & Keith, R. A. (1973). Behavioral mapping in a rehabilitation hospital. *Rehabilitation Psychology, 20*(4), 148-155. doi: 10.1037/h0090900

Milke, D. L., Beck, C. H. M., Danes, S., & Leask, J. (2009). Behavioral mapping of residents' activity in five residential style care centers for elderly persons diagnosed with dementia: Small differences in sites can affect behaviors. *Journal of Housing for the Elderly, 23*(4), 335-367. doi: 10.1080/02763890903327135

North American Industry Classification System (NAICS). (2007). *Section 722110 Full-service restaurants.* Retrieved from http://www.naics.com/censusfiles/ND722110.HTM

Occupational Safety and Health Administration (OSHA). (2000). *Ergonomics: The study of work* [Brochure]. Retrieved from: https://www.osha.gov/Publications/osha3125.pdf

Pugsley, D. & Haynes, B. (2002). An alternative use of space in government office accommodation. *Facilities, 20*(1/2), 34-40. doi: 10.1108/02632770210414272

Reynolds, D. (1998). Productivity analysis: In the on-site food-service segment. *Cornell Hospitality Quarterly, 39*(3), 22-31. doi: 10.1177/001088049803900307

Rowley, G., & Purcell, K. (2001). 'As cooks go, she went': Is labour churn inevitable?

International Journal of Hospitality Management, 20(2), 163-185. doi: 10.1016/S0278-4319(00)00050-5

Sabbag, C., & Hepsag, F. (2011). Hygiene of touristic hotel kitchens: The case in Adiyaman, SE Turkey. *Pakistan Journal of Nutrition, 10*(6), 514-518. doi: 10.3923/pjn.2011.514.518

Schwarz, B., Chaudbury, H.,& Tofle, R. B. (2004). Effect of design interventions on a dementia care setting. *American Journal of Alzheimer's Disease and Other Dementia, 19*(3), 172-176. doi: 10.1177/153331750401900304

Sherman, S. A., Varni, J. W., Ulrich, R. S., & Malcarne, V. L. (2005). Post occupancy evaluation of healing gardens in a pediatric cancer center. *Landscape and Urban Planning, 73(*2-3), 167-183. doi: 10.1016/j.landurbplan.2004.11.013

Simons, T., & Enz, C. A. (1995). Motivating hotel employees: Beyond the carrot and the stick. *Cornell Hotel and Restaurant Administration Quarterly, 36*(1), 20-27. doi: 10.1177/001088049503600114

Slack, N., Chambers, S., & Johnson, S. (2007). *Operations Management*. Essex, UK: Pearson Education Limited.

Smith, R., Matthews, R. M., & Gresham, M. (2010). Pre- and post occupancy evaluation of new dementia care cottages. *American Journal of Alzheimer's Disease and Other Dementias, 25*(3), 265-275. doi: 10.1177/1533317509357735

Spendolini, M. J. (1992). *The Benchmarking Book*. New York, NY: American Management Association.

Tangen, S. (2002). *Understanding the concept of productivity*. Proceedings of the 7th Asia Pacific Industrial Engineering and Management Systems Conference (APIEMS2002). Unpublished conference paper, December 18-20, 2002. Taipei, Taiwan. Retrieved from

http://www.slideshare.net/siddharth4mba/understanding-the-concept-of-productivity

Tanja-Dikstra, K. (2011). The impact of bedside technology on patients' well-being. *Health Environments Research Design & Journal, 5*(1), 43-51. Retrieved from https://www.herdjournal.com/article/impact-bedside-technology-patients-well-being

Wang, X., & Tian, X. (n.d). A workflow and layout study at ETSU market place. Retrieved from http://www.wangxiqiao.org/My%20Course%20Projects/A%20Workflow%20and%20Layout%20Study%20at%20ETSU%20Market%20Place.pdf

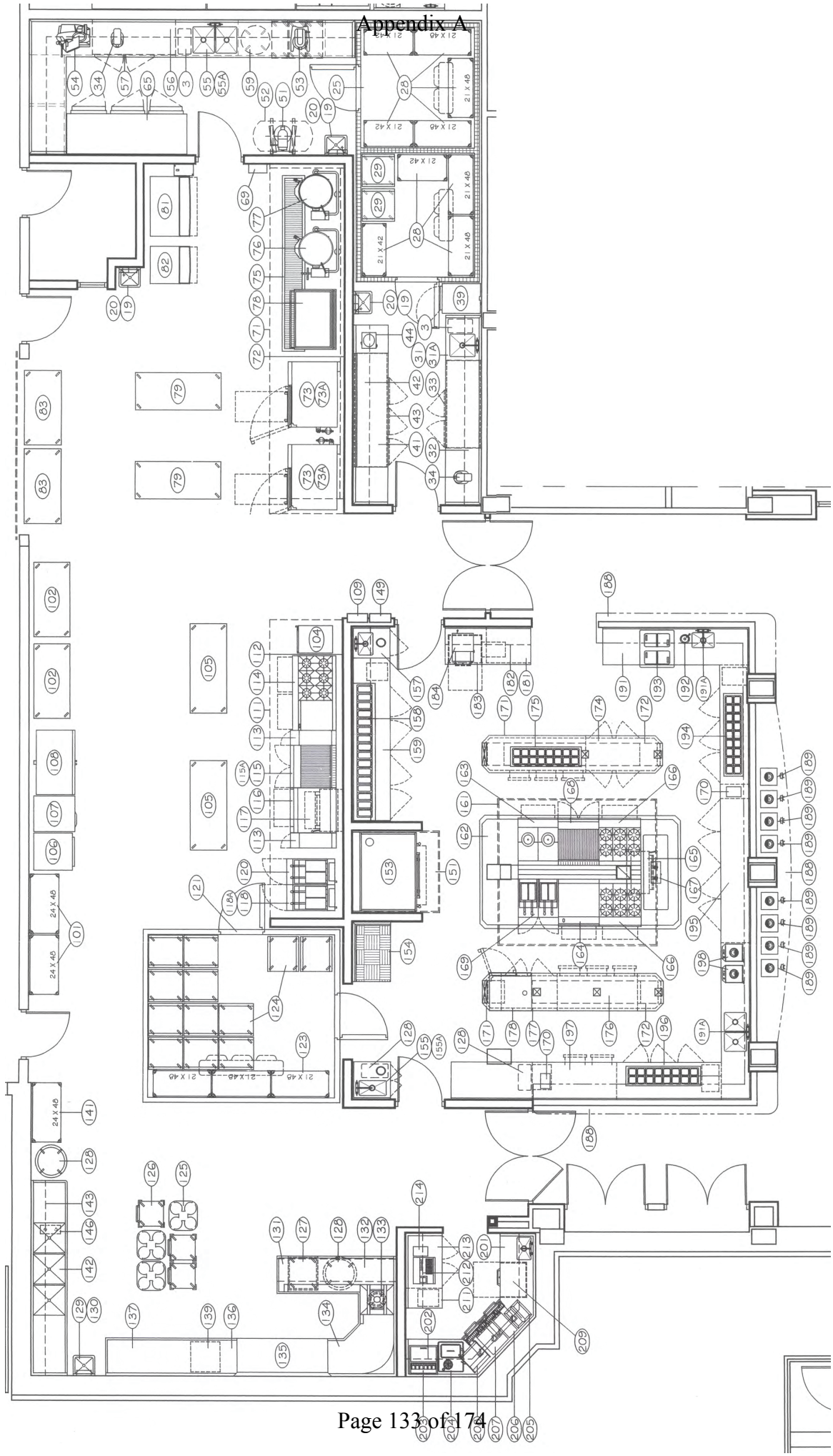
Waxman, L. (2006). The coffee shop: Social and physical factors influencing place attachment. *Journal of Interior Design, 31*(3), 35-53. doi: 10.1111/j.1939-1668.2006.tb00530.x

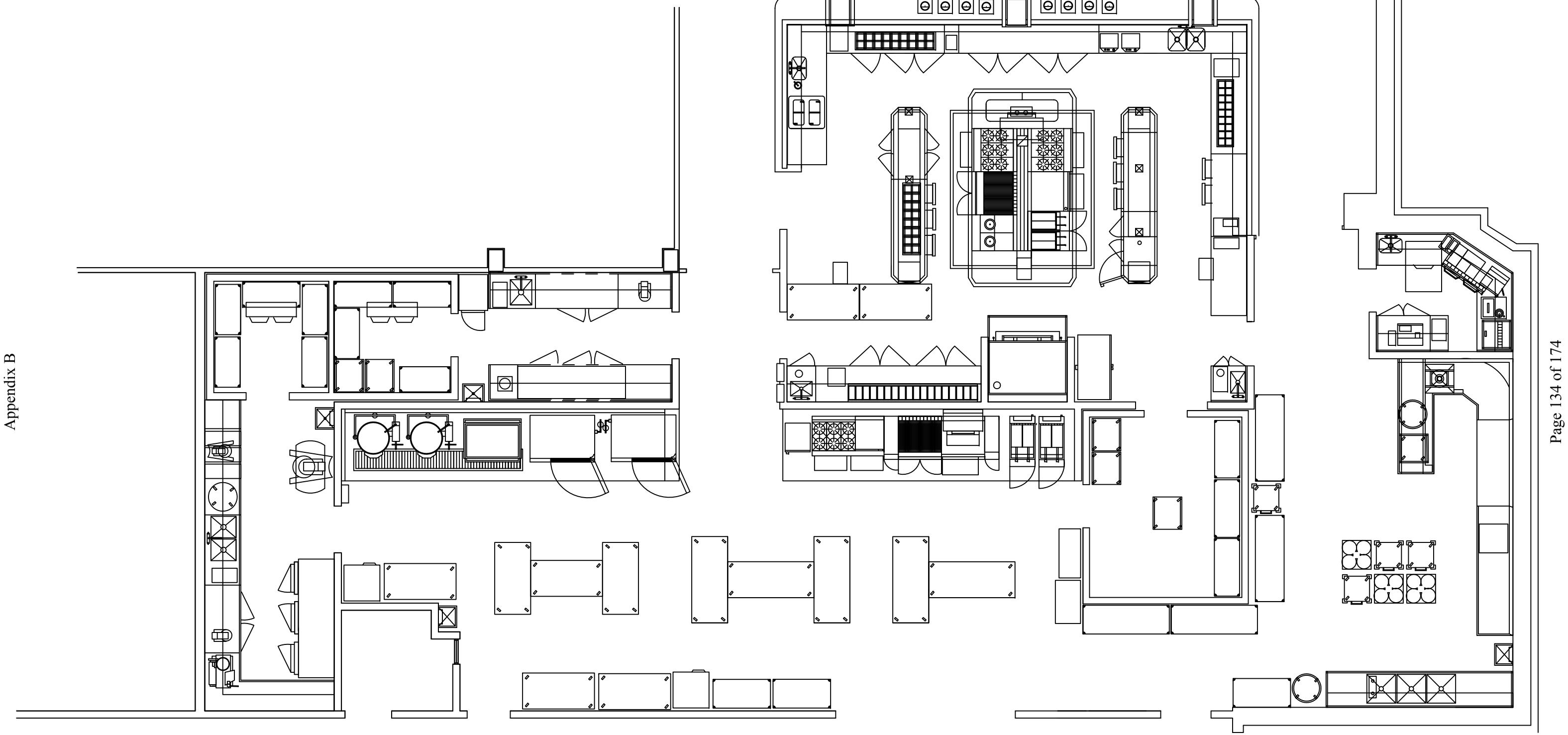
Wasmuth, W. J. (1983). Managing employee turnover: Why employees leave. *The Cornell Hotel and Administration Quarterly, 24*(1), 11-18.

Wild, R. (1989). *Production and operations management: Principles and techniques* (4th Ed.). London, UK: Cassell Educational Limited.

Young, C. A., & Corsun, D. L. (2010). Burned! The impact of work aspects, injury, and job satisfaction on unionized cooks' intentions to leave the cooking occupation. *Journal of Hospitality & Tourism Research, 34*(1), 78-102. doi: 10.1177/1096348009349816

Zuber, A. (2001, May 21). A career in food service: High turnover. *Nation's Restaurant News.* Retrieved from: http://infotrac.galegroup.com/itw/infomark/730/973/18750107w16/purl=rc1_BIM_0_A75100597&dyn=21!xrn_89_0_A75100597?sw_aep=naal_aub





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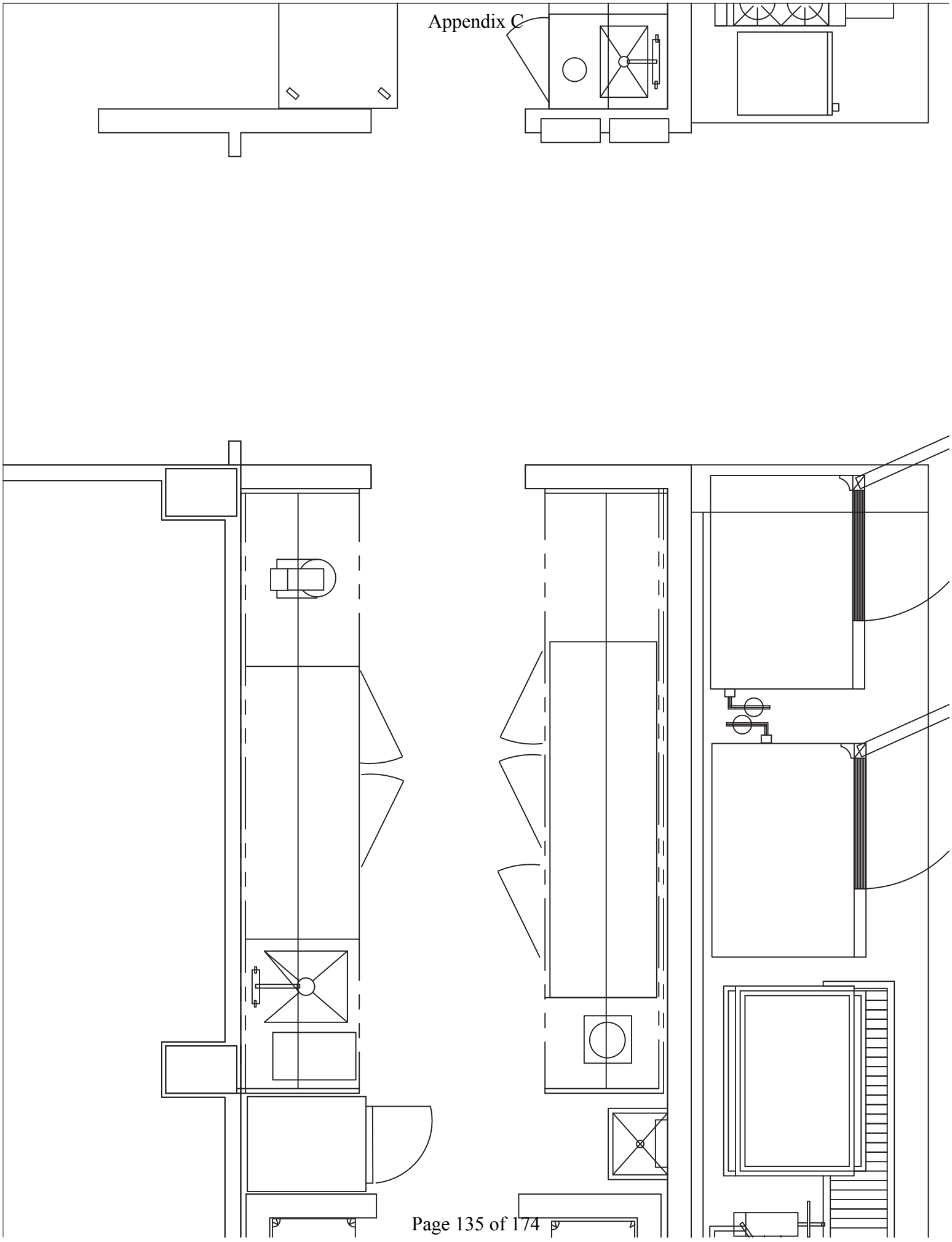
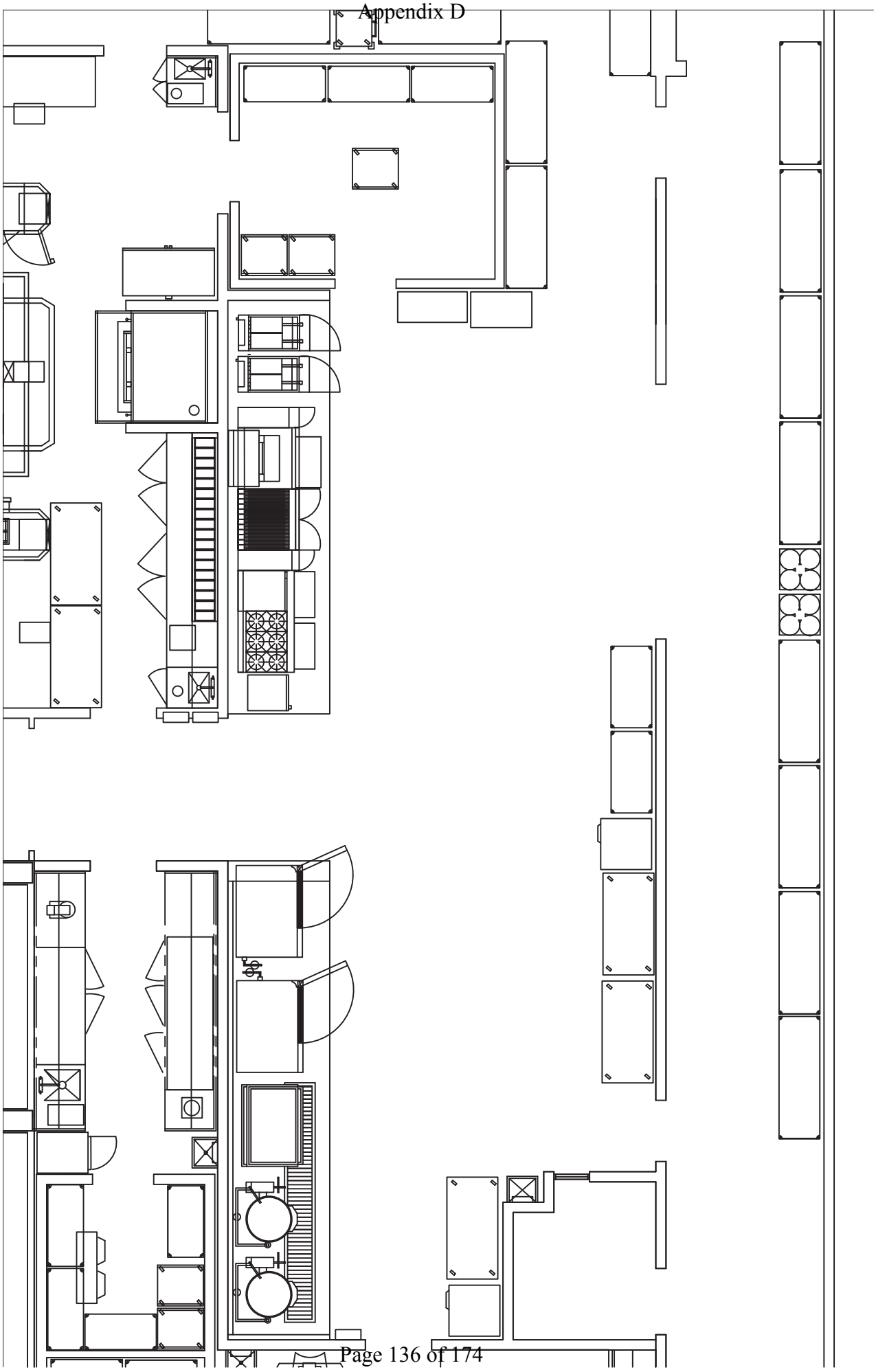
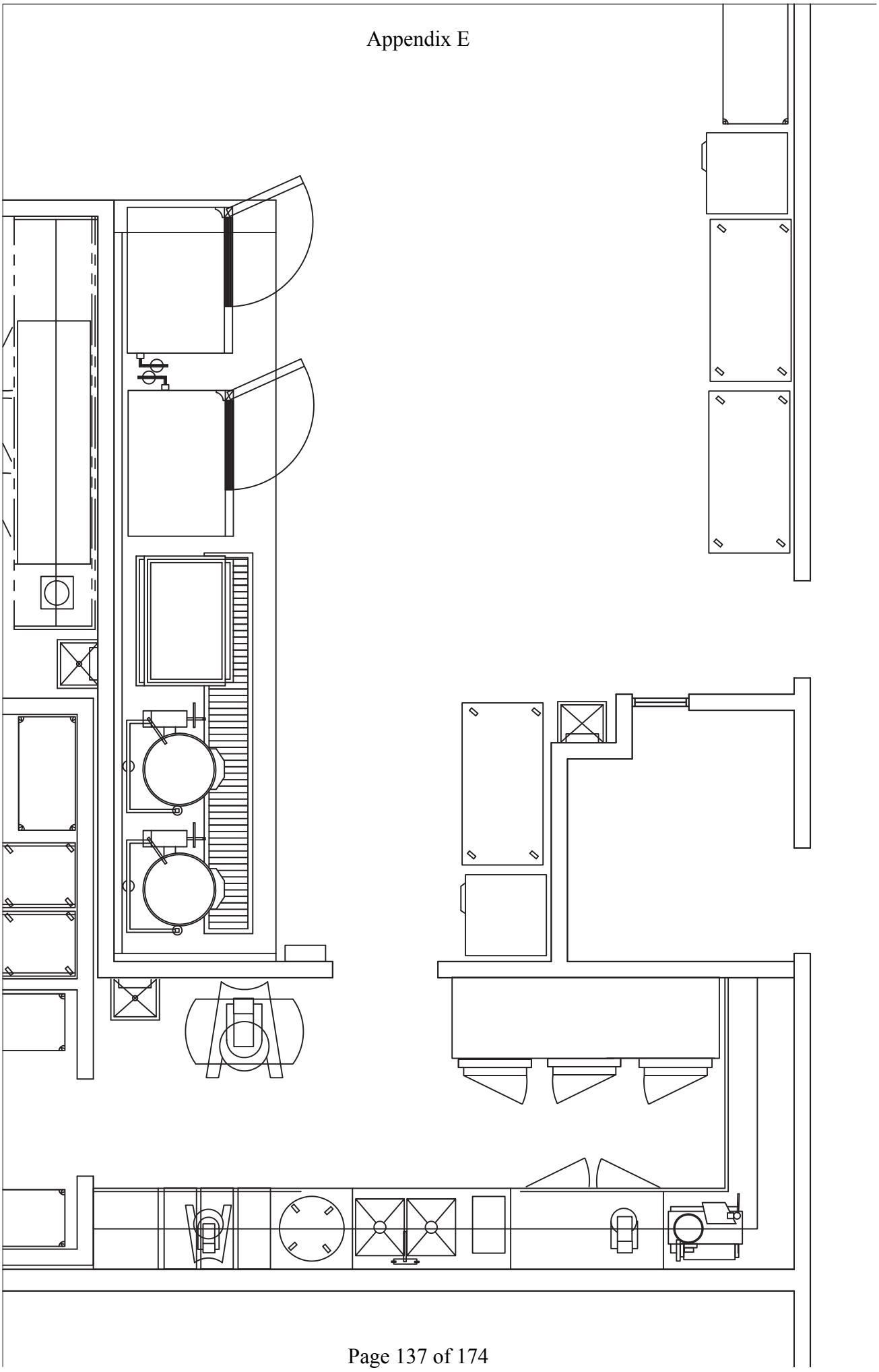
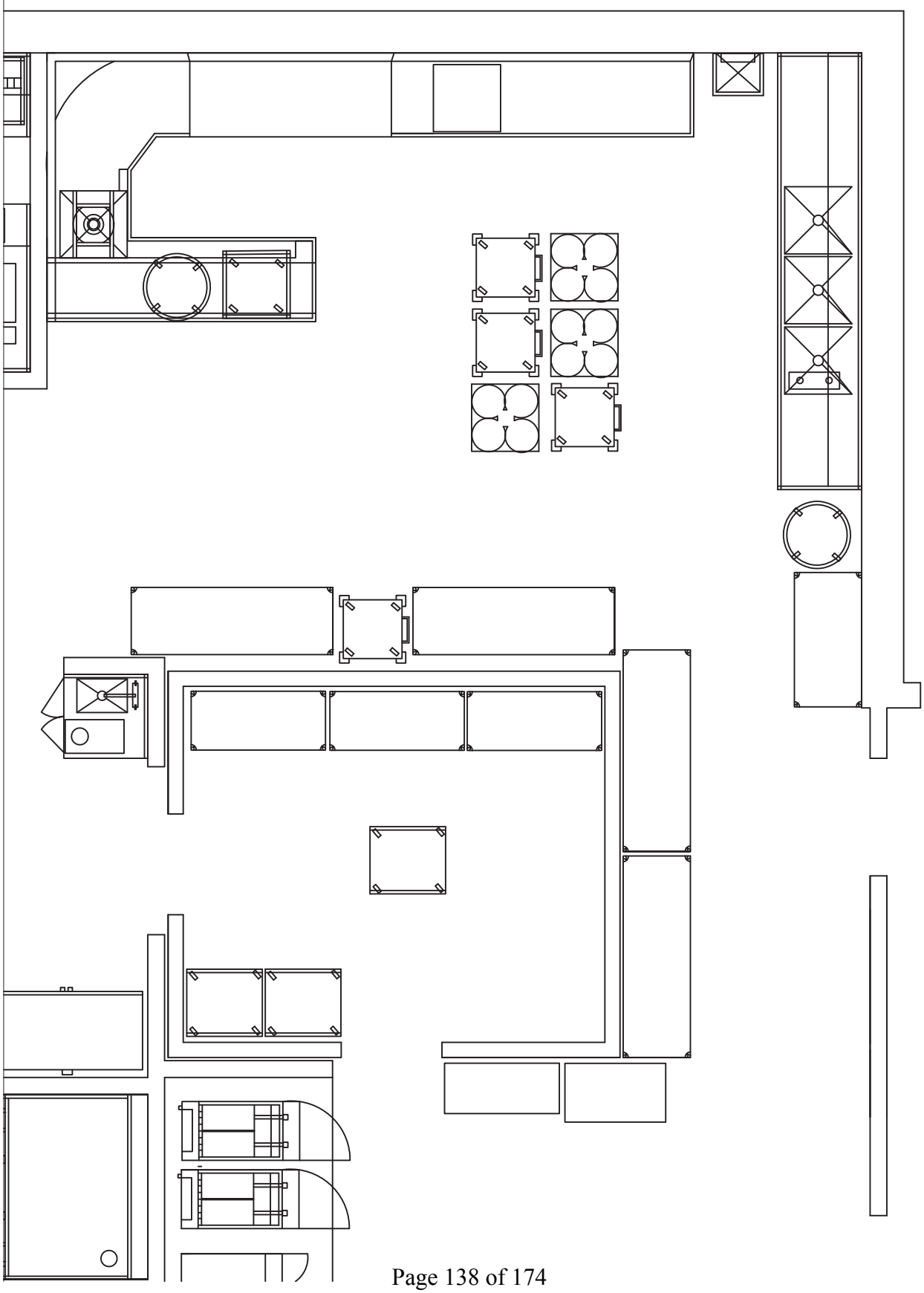
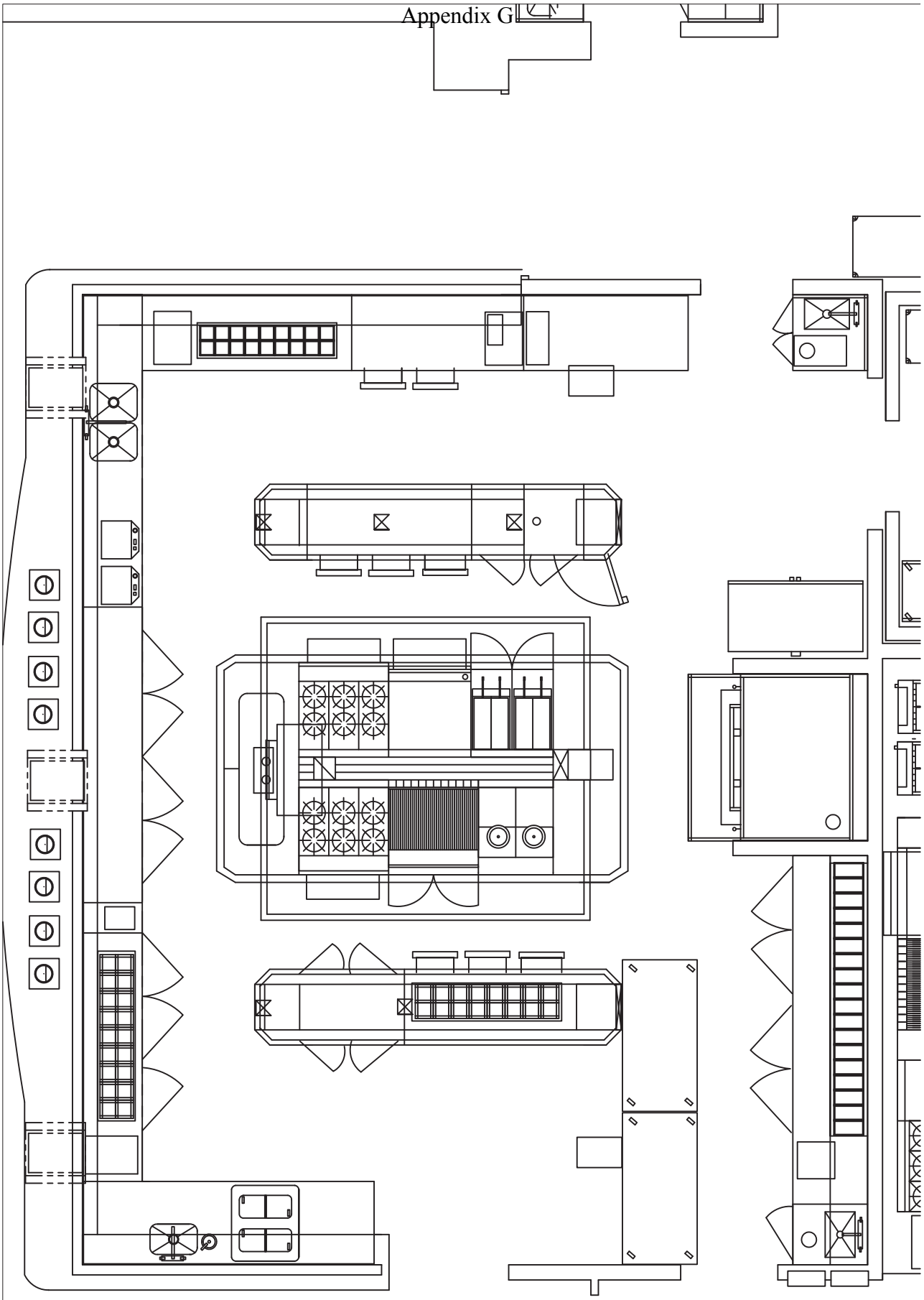










DATE: _____ TIME: _____ CODE: _____

Check which job you were working when observed:

- ☐ Chef de partie
- ☐ Cook 1
- ☐ Cook 2
- ☐ Cook 3
- ☐ Demie Chef de partie
- ☐ Executive Chef
- ☐ Executive Sous Chef
- ☐ Pastry Assistant
- ☐ Pastry Chef
- ☐ Steward

☐ STEP 1: SURVEY

- If you have multiple job titles, answer this survey ONLY for the job you were doing tonight during the observation
- You may be observed multiple times over the course of several weeks and you may be asked to fill out a new survey packet each time. You will get another entry to win $50 for each packet you complete.

☐ STEP 2: BASE MAP

- Thinking of the work you did tonight, use the marker provided to mark your path around the kitchen.
- Note any places in the kitchen that you have challenges, such as:
  - Draw multiple walking lines if you repeatedly walk in one location
  - Circle problem areas in the kitchen, and briefly explain the issue
  - Place a star next to any places you run into other employees

☐ STEP 3: PHONE NUMBER

- Enter your phone number, below, if you'd like to be entered into a drawing for $50.
- _____

After you have completed all the above steps, contact Virginia Belt (Call/Text: 912-399-2096) or (virginialeebelt@gmail.com) in order for the packet to be picked up.

THANKS!

Survey Questions

1. What is your job title? Please check all that apply.
   - ☐ Chef de partie
   - ☐ Cook 1
   - ☐ Cook 2
   - ☐ Cook 3
   - ☐ Demie Chef de partie
   - ☐ Executive Chef
   - ☐ Executive Sous Chef
   - ☐ Pastry Assistant
   - ☐ Pastry Chef
   - ☐ Steward

2. How many years have you worked for Ariccia?
   - ☐ 0-6 months (less than 6 months)
   - ☐ 7-12 months (less than a year)
   - ☐ 13-18 months (between 1 and 1.5 years)
   - ☐ 19-24 months (almost 2 years)
   - ☐ 24-36 months (between 2-3 years)
   - ☐ 37-48 months (between 3-4 years)
   - ☐ over 4 years

DIRECTIONS: Please answer the following questions honestly and as thorough as possible. Remember, your answers are for the researchers eyes only!

3. How do you feel about the equipment and tools available to you in the kitchen in terms of being able to complete your job successfully? Please check only one box.

Very difficult	Somewhat difficult	Neutral	Somewhat successfully	Very successfully
☐	☐	☐	☐	☐

4. What tools or equipment, if any, are missing in order for you to complete your job successfully?

_____

_____

_____

_____

_____

**Please flip the page to continue to page 2 of the survey.

5. How do you feel about the amount of space you have to work in is helpful in doing your best work? Please check only one box.

Very unhelpful	Somewhat unhelpful	Neutral	Somewhat helpful	Very helpful
☐	☐	☐	☐	☐

6. Are there any changes to the physical environment that you wish you could make in order to do your job more effectively?

_____

_____

_____

_____

_____

7. If these changes were made, do you feel like you would be a more satisfied employee? Please check only one box.

No change to my satisfaction	Very little improvement to my satisfaction	Somewhat improvement to my satisfaction	Great improvement of my satisfaction
☐	☐	☐	☐

8. What other comments would you like to make about the layout of your workspace in the kitchen, or the kitchen as a whole?

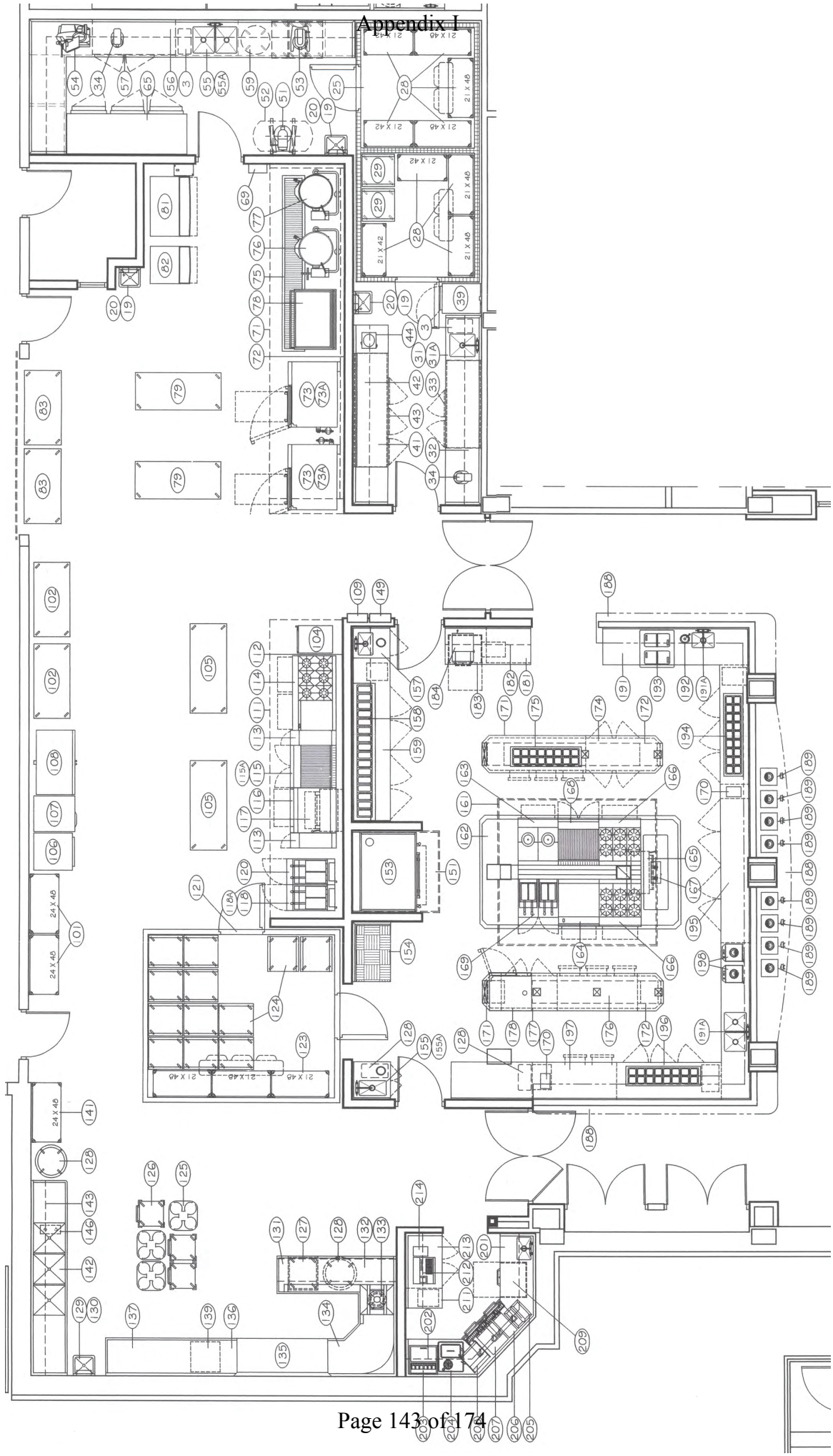
_____

_____

_____

_____

_____



Observation: Hesitates

Date	Time Stamp	Hesitates
6/10	7:37-8:01 am	1
BANQUET KITCHEN	11:00-11:22 am	
	11:23-11:40am	
	11:40-11:55	1
	11:56-12:09 pm	
	12:10-12:27	
	12:27-12:42	
	12:42-1:00	
6/11	7:54-8:05 am	1
BANQUET KITCHEN	8:05-8:13	2
	8:14-8:29	1
	8:29-8:38	
	8:38-8:46	
	8:48-8:59	1
	8:59-9:09	1
	9:10-9:22	2
	9:23-9:30	
	9:31-9:39	
	9:40-9:49	
	9:54-10:04	
	10:05-10:14	
	10:15-10:24	2

	12:20-12:38 pm	
	12:39-12:52	1
	12:53-1:08	
	1:11-1:25	
	1:27-1:36	2
	5:45-5:52 pm	
	6:03-6:15	
	6:16-6:21	
	7:36-7:44	
	7:45-7:50	
	8:08-8:22	
	8:23-8:33	
6/12	7:15-7:30am	
	7:31-7:37	
	7:38-7:47	
	7:47-7:56	
	7:56-8:13	
	8:14-8:26	
	8:27-8:37	
	8:38-8:48	
	8:48-9:01	
	9:02-9:13	
	9:14-9:25	
	9:26-9:42	
	9:43-10:05	

	10:06-10:15	
	5:31-5:45 pm	
	6:07-6:15	
	6:23-6:33	
	6:33-6:41	
	6:47-6:56	
	7:16-7:21	
	7:21-7:30	
	7:39-7:48	
6/13/13	7:02-7:18am	2
BANQUET KITCHEN	7:19-7:29	3
	7:29-7:38	
	7:41-7:50	
	7:51-7:58	2
	7:59-8:12	
	8:12-8:17	1
	8:17-8:24	2
	8:24-8:31	
	8:31-8:41	
	8:45-8:52	1
	8:52-9:00	
	9:04-9:07	
	9:08-9:14	
	9:14-9:19	1
	9:19-9:33	

	9:34-9:43	
	9:43-9:49	1
	9:53-10:02	1
	12:01-12:12 pm	
	12:12-12:16	
	12:16-12:23	
	12:23-12:29	
	12:33-12:38	
	12:38-12:44	
	12:45-12:52	
	12:52-12:59	
	1:00-1:09	
	1:10-1:26	
6/16/13	9:00-9:13 am	1
BANQUET KITCHEN	9:17-9:24	1
	9:24-9:31	5
	9:31-9:38	2
	9:38-9:46	1
	9:46-9:52	1
	9:52-9:56	1
	9:57-10:04	
	10:04-10:15	2
	10:15-10:23	
	10:23-10:29	2
	10:29-10:34	1

	10:35-10:40	3
	10:41-10:44	1
	10:44-10:50	
	10:51-10:58	3
	10:58-11:02	1
	11:07-11:14	
	11:14-11:23	
	11:24-11:34	3
	11:35-11:42	2
	11:42-11:50	
	11:50-12:00 pm	1
	4:20-4:34 pm	
	4:48-4:59	
	4:59-5:09	
	6:12-6:24	
	6:24-6:33	
	6:46-6:59	
	7:00-7:10	
	7:10-7:17	
6/17/13	6:24-6:42 am	1
BANQUET KITCHEN	6:48-6:56	
	6:56-7:03	
	7:04-7:11	2
	7:12-7:22	2
	7:24-7:29	

	7:35-7:44	
	7:44-7:52	
	7:52-7:59	2
	7:59-8:10	1
	8:10-8:19	
	8:19-8:27	3
	8:27-8:38	
	8:38-8:46	1
	8:48-8:58	1
	8:58-9:05	2
	9:06-9:15	2
	9:15-9:20	
6/19	6:05-6:21 am	
	6:22-6:31	
	6:32-6:44	
6/19	11:48-11:58am	
	11:58am-12:05pm	
	12:05-12:12	
	12:13-12:22	
	12:22-12:45	
	12:46-12:53	
	12:53-1:00	
	1:00-1:18	
	1:18-1:29	
	1:30-1:37	

	1:37-1:44	
	1:46-1:55	
	2:00-2:09	
	2:09-2:23	
	2:23-2:31	
	2:31-2:40	
	2:40-2:49	
6/20/13	8:48-9:02	
BANQUET KITCHEN	9:03-9:13	
	9:14-9:19	1
	9:21-9:26	
	9:27-9:39	2
	9:40-9:48	2
	9:53-10:03	2
	10:03-10:19	
	10:20-10:29	
	10:29-10:36	1
	10:36-10:45	
	10:46-10:57	1
	10:58-11:05	2
	11:05-11:15	
	11:22-11:48	1

MANAGEMENT MEETING OUTLINE

INTRODUCTIONS

DISCUSSION
- The goal is to have all expectations and concerns addressed, feel free to interject with input and questions that the 3 of us could answer

PROCESS (2 Parts)
- Observations: currently scheduled 54 hours over 3 weeks time. Goal would be to have an observation during breakfast, lunch and dinner, on different days of the week **see attached schedule**
- Surveys: after 2 hour observation, ask employees to participate in a survey process. They will be given a packet that contains a kitchen map and survey **see mock packet**
    - Management involvement: discussion with staff about the fact that I am doing observations 100% for my thesis alone, that I am not affiliated with the restaurant and that my observations have absolutely nothing to do with their jobs (example: beginning of shift meeting, monthly meeting, email?)

QUESTIONS:
- Is the process okay with you?

- What are your major concerns?

- What is the protocol to be followed in the kitchen?

    - Who would you like me to notify once I am in the kitchen?

    - I plan to where no slip shoes, are there any other attire requirements I need to follow?

    - Where are the key places for me to stand to observe the following:

- How strictly does the schedule need to be adhered to? (example: if I notice after the first observations, that on Tuesday lunch I would rather move from 11:00-1:00, is that an option?)

INTRO AND QUESTIONS TO ASK IN FIRST STAGE OF INTERVIEWS

INTRODUCTION

As your chef has informed you, I am Virginia Belt and I am here today to introduce myself and give you an opportunity to participate in a study to assess the interaction of you and how you do your job with the space and equipment around you. I will be observing the kitchen during the shift and will be taking notes of what I see. Your specific behavior will not be reported to the management team, I am simply interested in what types of things you do during a shift, as well as the movements you make around the kitchen to complete your job.

Your participation in this study is completely voluntary. If you decide not to participate, it will not affect your job in any way. Your responses and outcomes will remain completely confidential, and there will be no way to identify whether you chose to participate or not. So the decision to participate is completely voluntary.

As a participant, you have the option of having your name entered into a raffle and a winner will be drawn at the end of the study. The winner will receive $50 cash.

After each observation, I will be approaching the employees I observe and handing them a packet.

I am now going to ask some questions about your kitchen. I ask that you answer as freely as possible, knowing that your responses will not be repeated to management.

QUESTIONS

- Thinking of the physical space, what is the most annoying part about the kitchen?
- Will you please identify the problem areas you feel are the most bothersome, in order for me to identify areas where I could stand during observations?
- Is there anything about the physical you would like me to know before I begin observations?
- What are your concerns about me observing your space?

EXAMPLES OF QUESTIONS TO ASK EMPLOYEES DURING INTERVIEWS

1. How do you feel about the equipment and tools available to you in the kitchen in terms of being able to complete your job successfully? What tools or equipment, if any, are missing?

2. During _____(insert activity)_____, it seemed that _____(insert observation)_____. Do you feel there is a better way to organize your physical environment to do this task more efficiently? [Repeat question for each activity as needed]

3. How do you feel about the amount of space you have to work in is helpful in doing your best work? What changes, if any, would you make to the physical space?

4. Are there any changes to the physical environment that you wish you could make in order to do your job more effectively?

5. If these changes were made, do you feel like you would be a more satisfied employee?

6. What other comments would you like to make about the layout of your workspace in the kitchen, or the kitchen as a whole?

SHORT HAND BEHAVIORS TO BE USED IN OBSERVATIONS

Shorthand	Longhand
X	Exits
WT	Walks through
HES	Hesitates
TT	Talks to
TC	Trash can
NTR	Enters
WSH	Washes hands
PLTS	Plates food
DRP	Drops something
STR	Stirs pot
S	Stands in place without doing anything
RT	Returns

QUESTION 4

Location of observation	Responses
Banquet Kitchen	• Storage, utensils • Not having enough pots, pans, & utensils. Not enough storage • Its not that tools are equipment are really missing, the problem lies in people not caring for these products as they should to ensure longevity & efficiency • Spatula, lids, tongs • More storage area • *Inside freezer, bakery oven, bakery stove, better mixers, a door!* • *Bakeshop needs its own oven & own storage area. An outside freezer/cooler in Alabama is most impractical & effects quality of product emensly! Bakeshop should have its own mini-stovetop or single induction burner to reduce travel distance w/ hot products. One efficient mixer as opposed to three less-than-adequate ones*
Bakery	• bakery oven, bakery stove, inside bakery freezer, more storage space, more tablespace, better mixers • we need more oven and more space. and we want have good mixer • Bakeshop needs oven, ice cream maker, better freezer/cooler, more storage
Restaurant Kitchen	• Pasta bar tools especially burners. This is the only problem I have, to get here on Tuesday and have nothing to cook on or to serve customers.. If we had new ones we would definitely do better and have an easier Tuesday night • More 6 pans, ramikins, wooden planks, small ladels, squeeze bottles, large and small bowls, plastic lids for tomatoes, plastic to go containers • More 6 pans, ramikins, wooden planks, small ladels, squeeze bottles, large and small bowls, plastic lids for tomatoes, plastic to go containers • Food storage is a big issue. Right size containers
Dish Pit	• Gloves and cold air • Gloves and cold air (so hot back there!)

Location of observation	Responses
Prep Kitchen	• Pans to store food. Not enough. When we are busy it is hard to get Robo Coube, or other one item things. Employees tend to bring things from home to make the job more successful • Quantity of smallwares & storage • More storage for food. More utensils

QUESTION 6

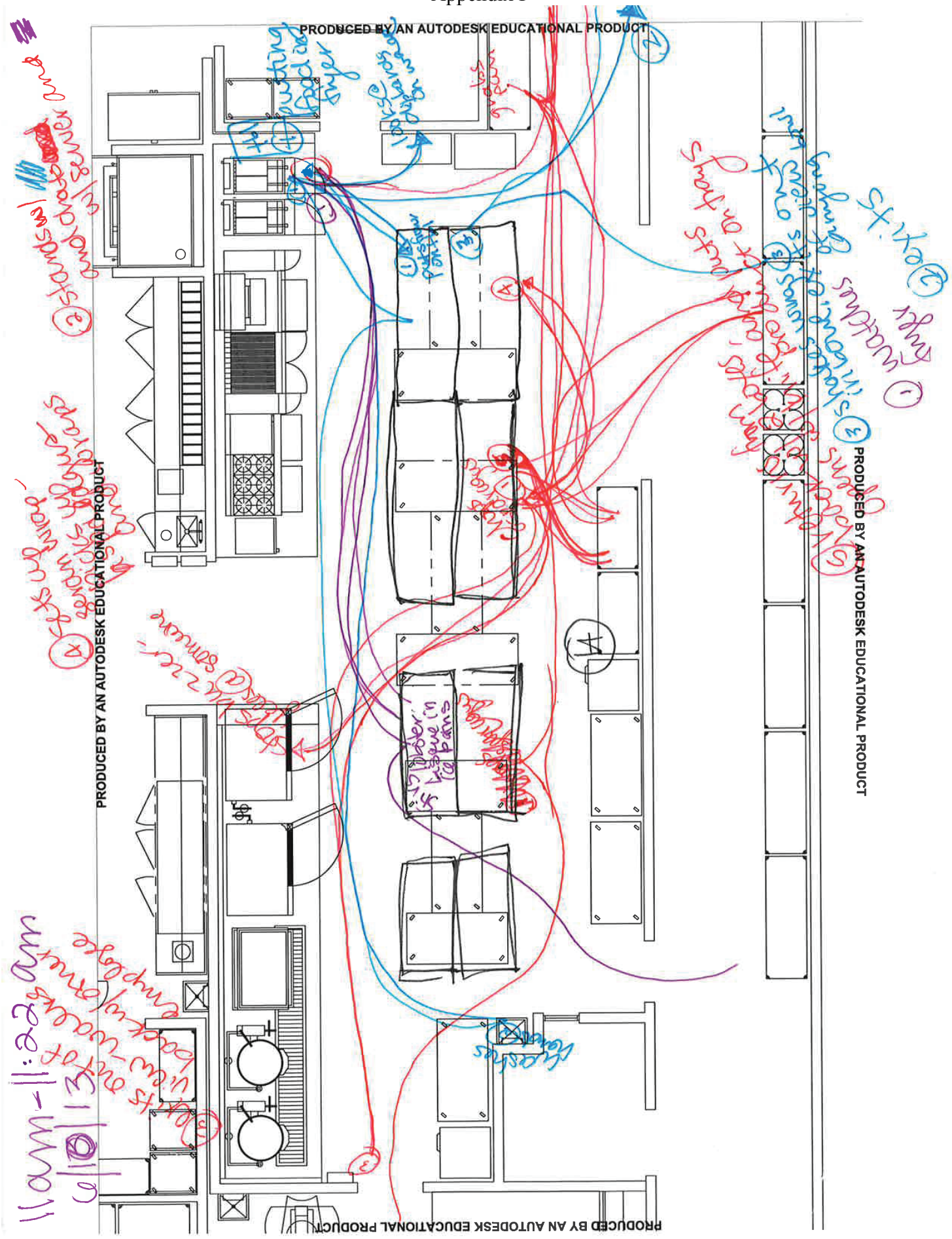
Location of observation	Responses
Banquet Kitchen	• Way too much area to cover • Space is fine but everything is spread out way too much. More storage for spices rags, and such • No, I've grown accustomed to the general dynamic of my work area in order to execute my tasks with little or no difficulty • Cooler & freezer that is located outside would be a huge time saver if it was located within the kitchen • less walking • *More storage space (cooler/dry), bigger shop, more table space* • *Of course everyone wants more space. The bakeshop is average in size but it a more efficient mixer was utilized then more table space would be available. Storage is always needed.*
Bakery	• Tablespace, storage • We need big table for work • More table space, different table set-up in big kitchen
Restaurant Kitchen	• All lines accessible one way instead of it being a maze. Getting product to and from each line. Especially when you are working more than one line one night, in my case pizza and pasta • Remove the large tile foundation pole! • Remove the large tile foundation pole • For things to be more in one area instead of being spread out • Correct laddles, spoons, hot well pans & lids
Dish Pit	• No • No

Location of observation	Responses
Prep Kitchen	• In Piccolo, we have made our own spice rack. This is so we don't have to leave our work space. Problem is that everyone knows we are organized so they come and get our stuff instead of there own • Main cooler & freezer need to be located inside • More storage in prep area so that there is less walking around

QUESTION 8

Location	Responses
Banquet Kitchen	• Not good for one or two people. Designed for four people. • Hot boxes are not located in the proper locations. We must walk away from our workstations to access them. • N/A • *It's a tight squeeze* • *The bakeshop is spread as thinly as possible. If there were more room then a rearrangement/equipment addition would be a great improvement*
Bakery	• Tight fit
Restaurant Kitchen	• Spaces around pizza line & oven are tight, as well as by pasta & salad. More space would definitely help in my opinion • It is very tight, and cold stations such as salad and dessert should be next to each other if one is working both • It is very tight, and cold stations such as salad and dessert should be next to each other if one is working both • Hard for 1 or 2 people to run Ariccia. It is set up for 4 people
Dish Pit	•

Location	Responses
Prep Kitchen	• It is a big area. It is not set up for a 1 or 2 person operation. It is a rat trap if a lot of ala carte orders come in. Running around instead of lateral movements. There should not be 4 lines. 1 line and 4 stations would be much better. • Organization is an issue, to many changes make weekly making it confusing & time consuming to find items • It is not set up for a 1 or 2 person operation. It is only set up for a full crew • Kitchen needs a redesign due to change in time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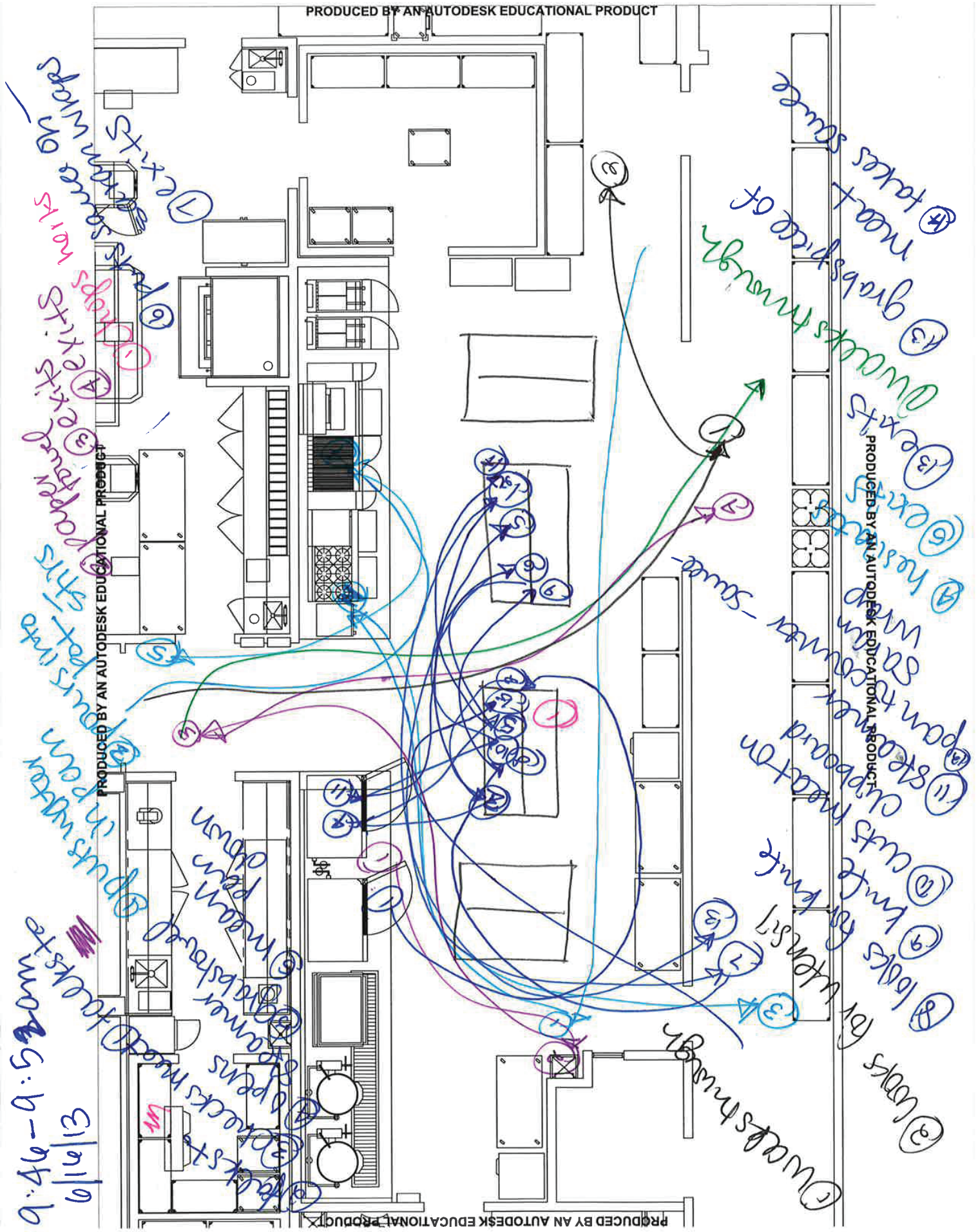
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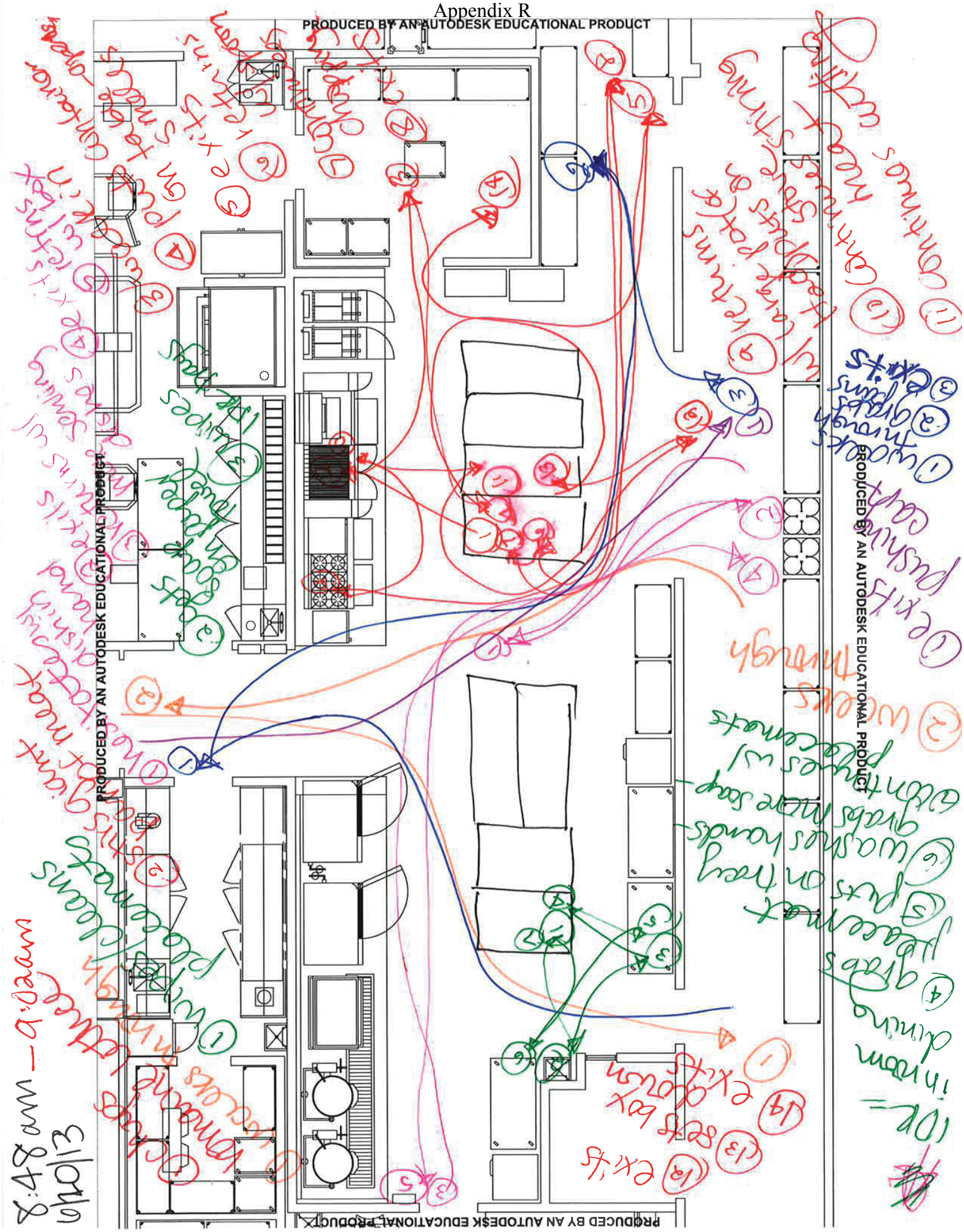
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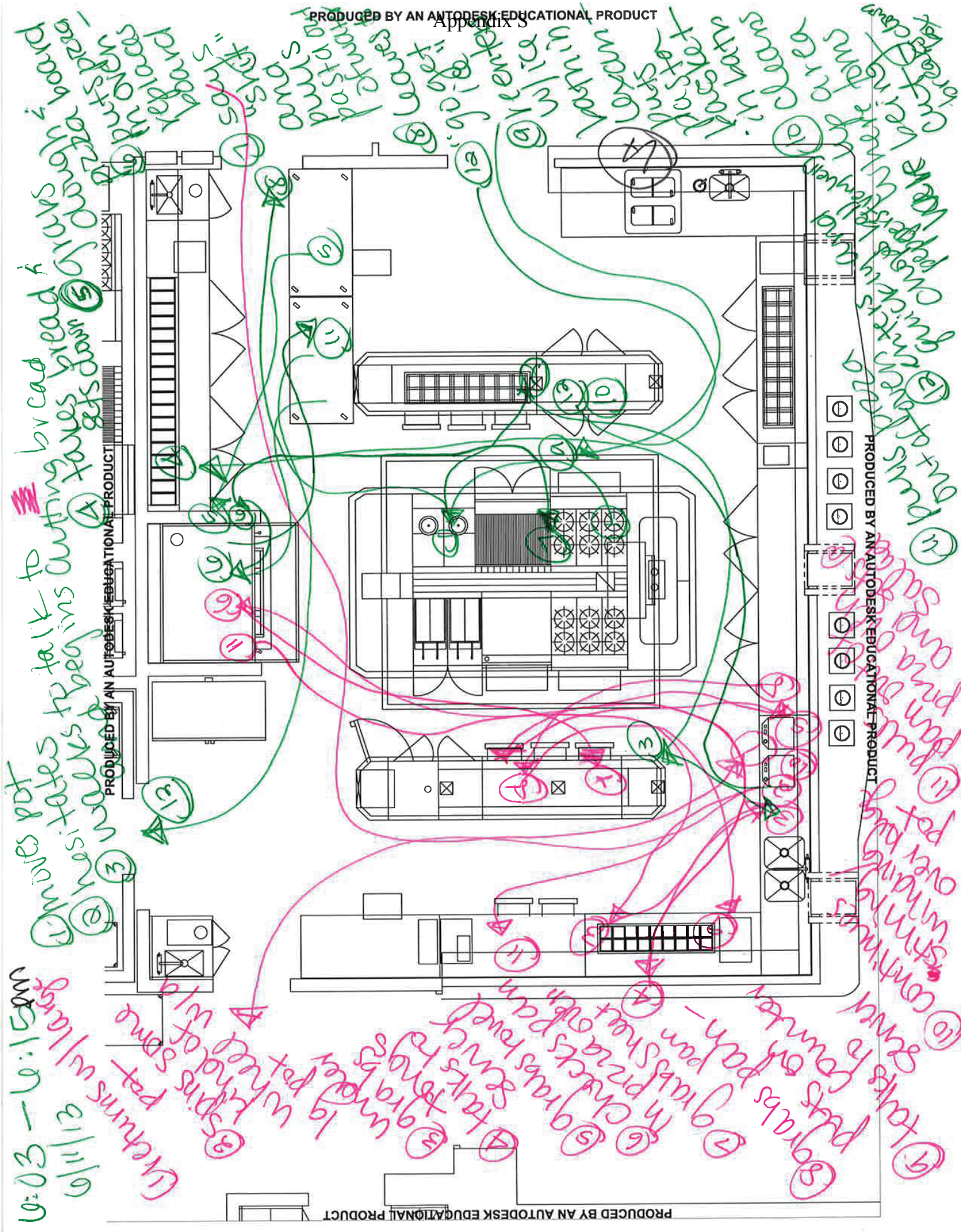
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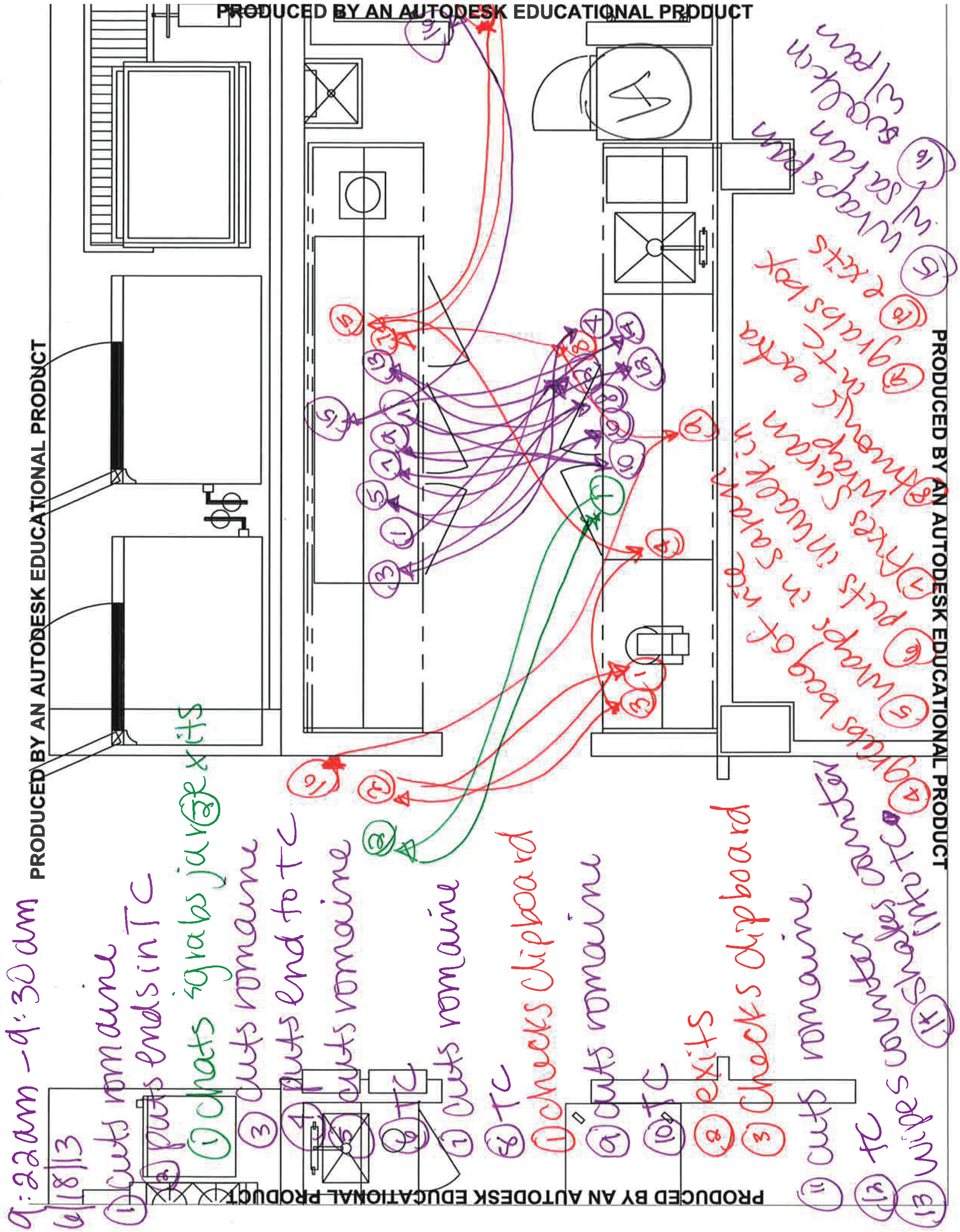
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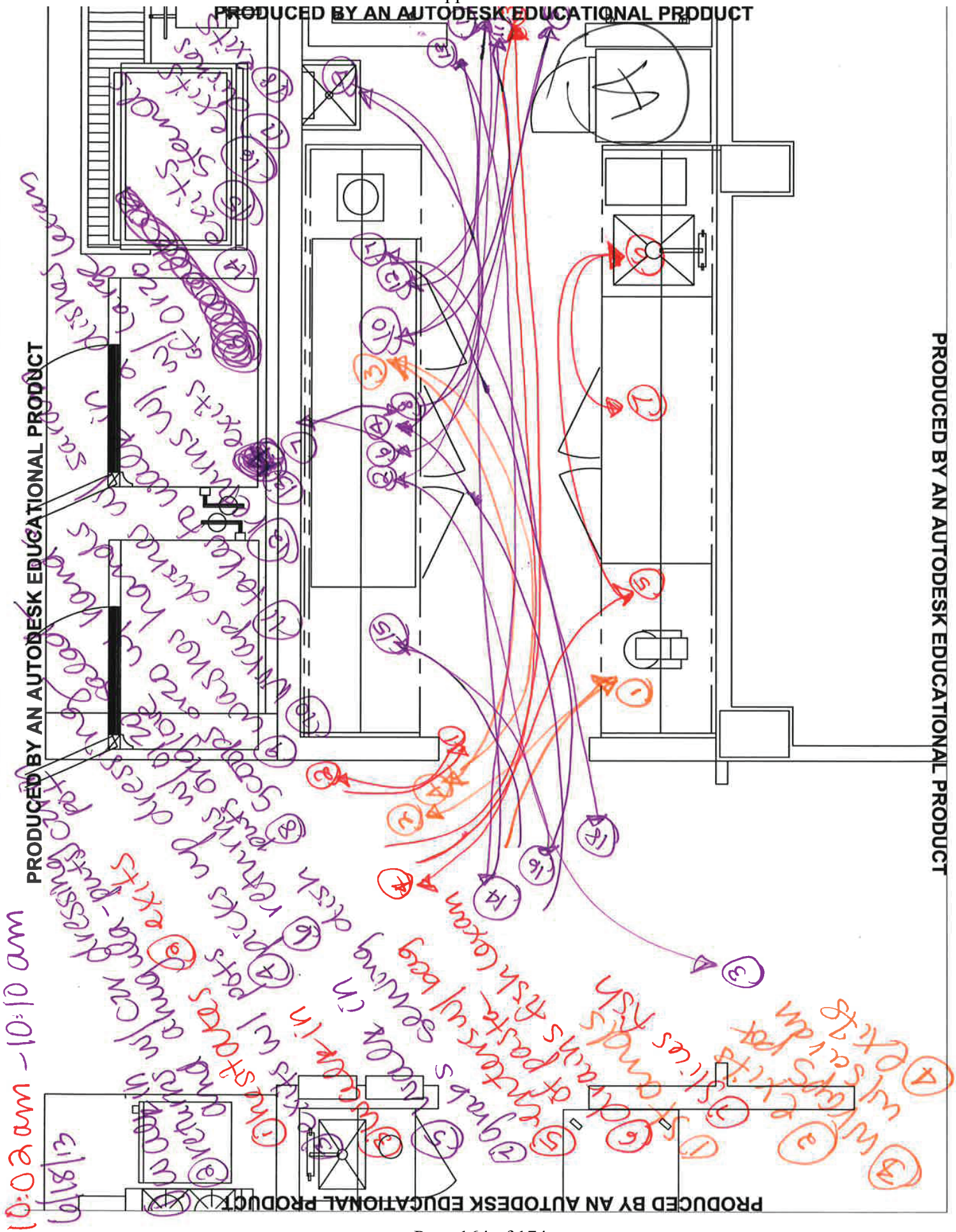
9:22am – 9:30am
6/18/13
1 cuts romaine
2 puts ends in TC
1 chats & grabs jar 2 exits
3 cuts romaine
4 puts end to TC
5 cuts romaine
6 TC
7 cuts romaine
8 TC
1 checks clipboard
9 cuts romaine
10 TC
2 exits
3 checks clipboard
11 cuts romaine
12 TC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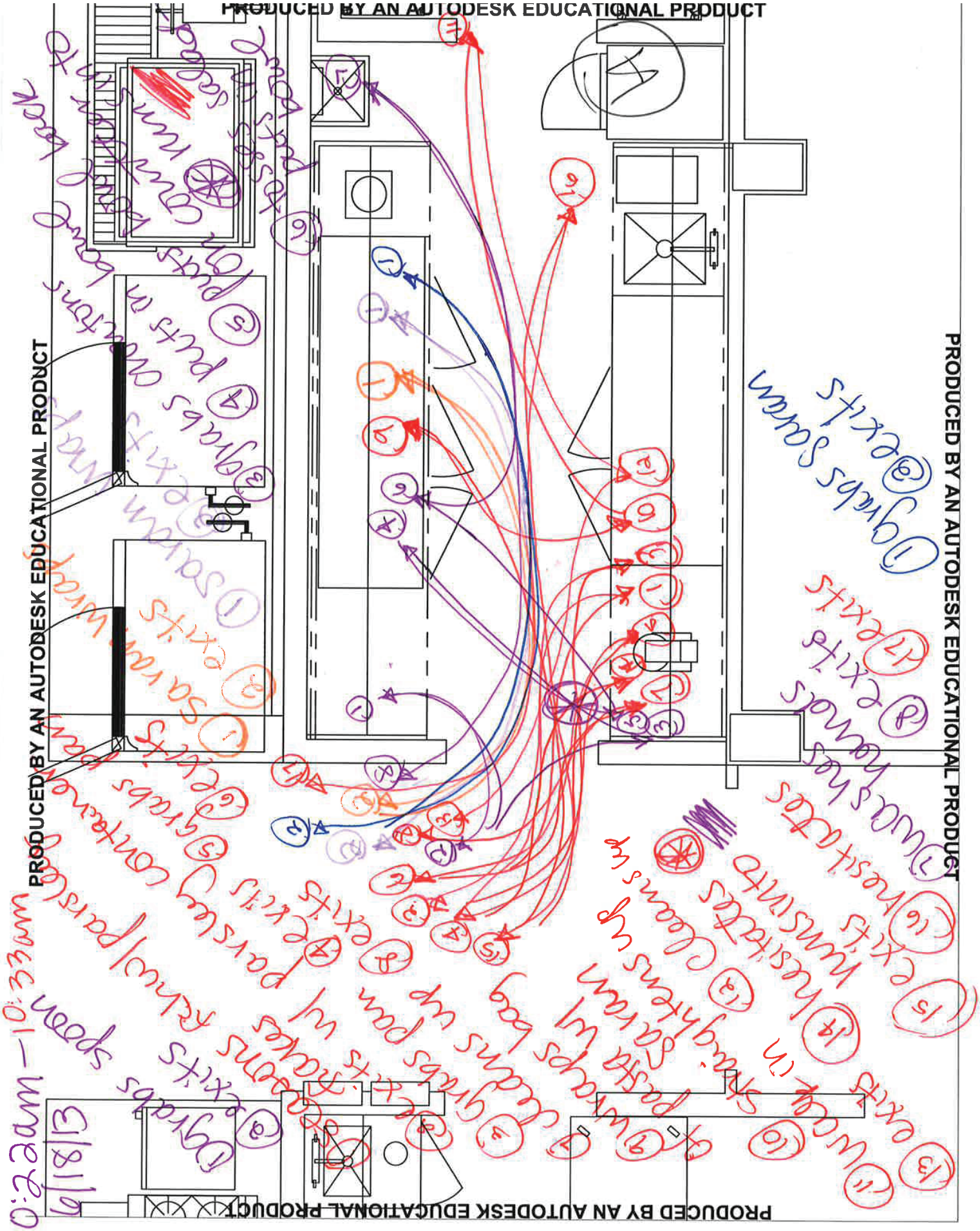
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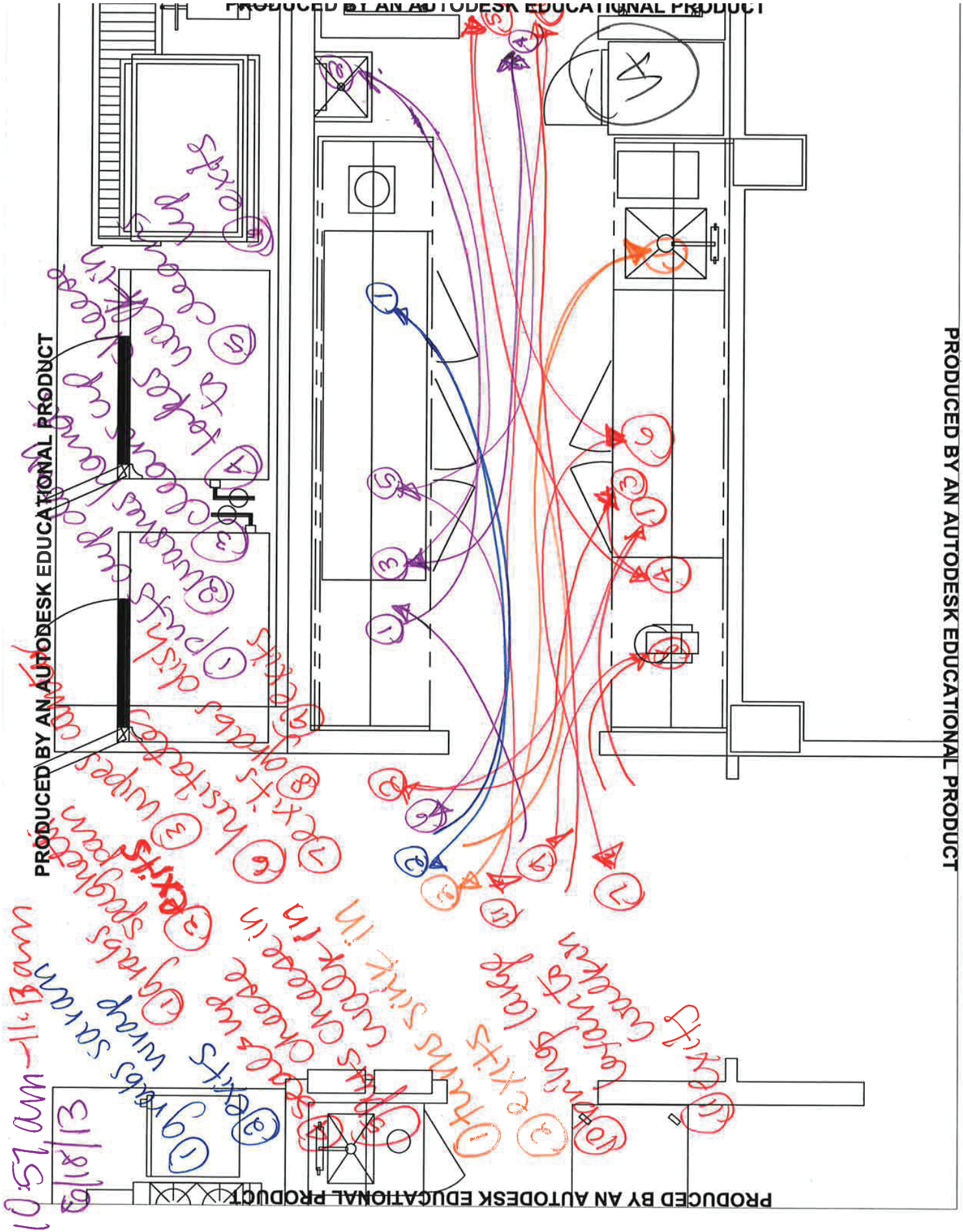
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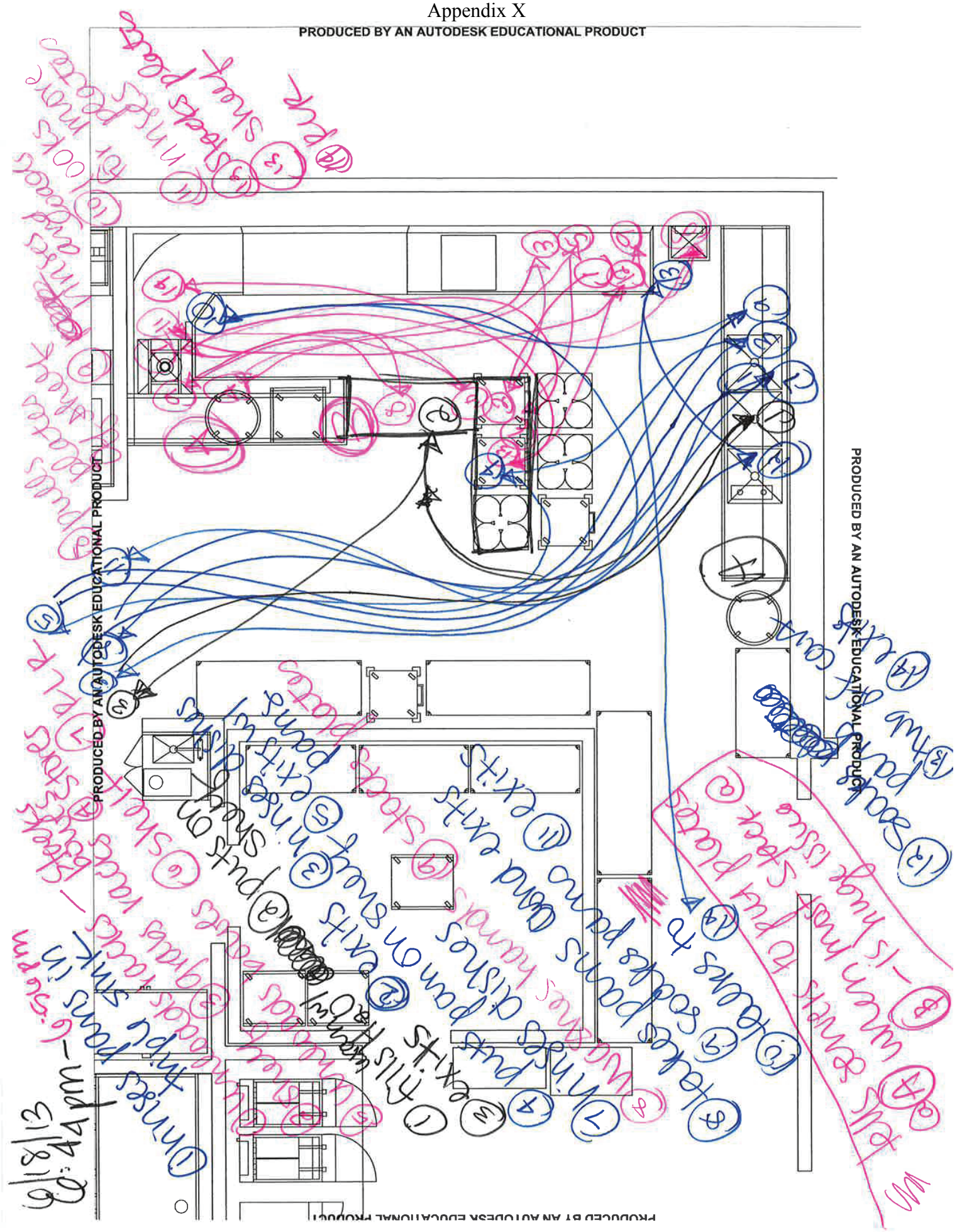
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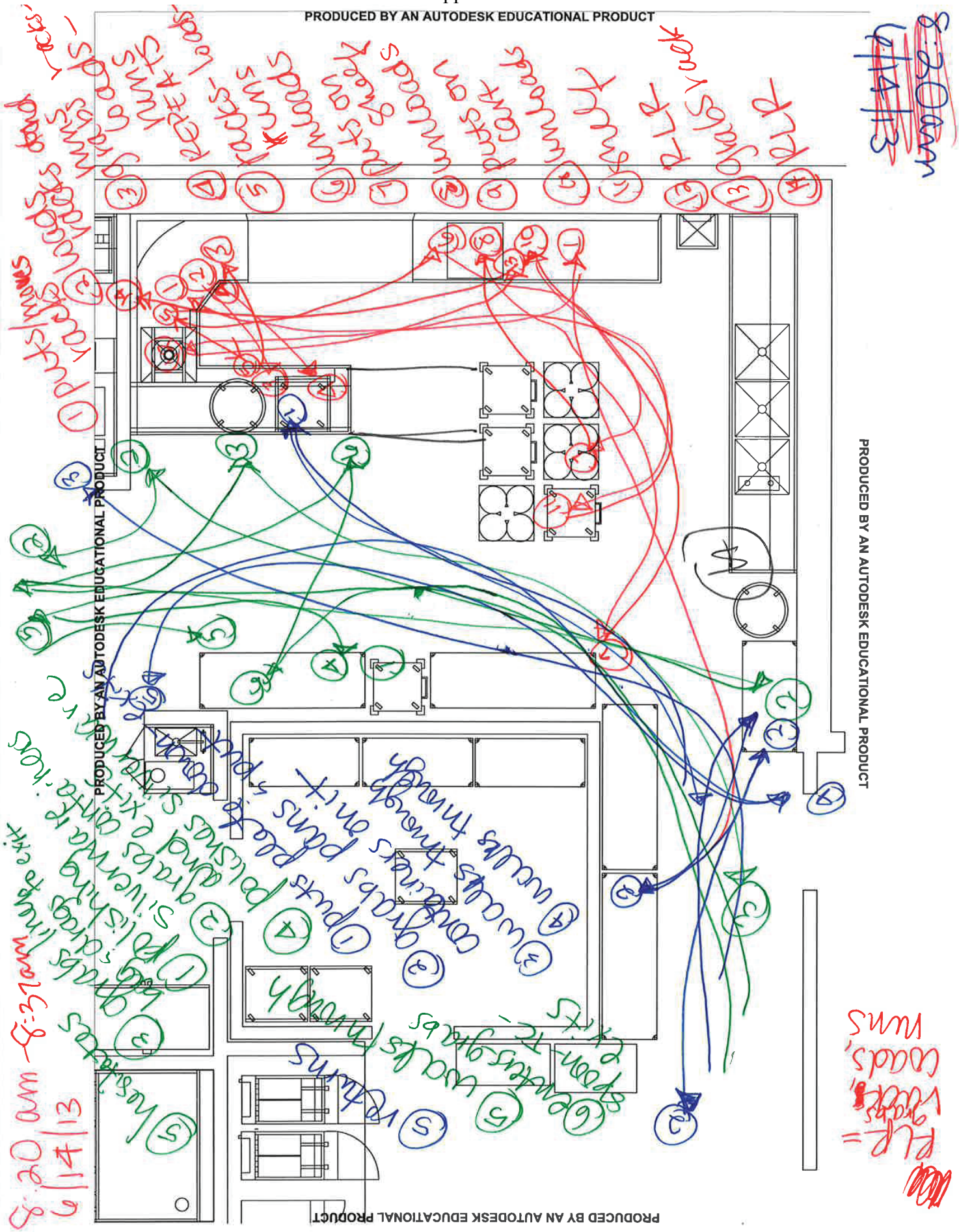
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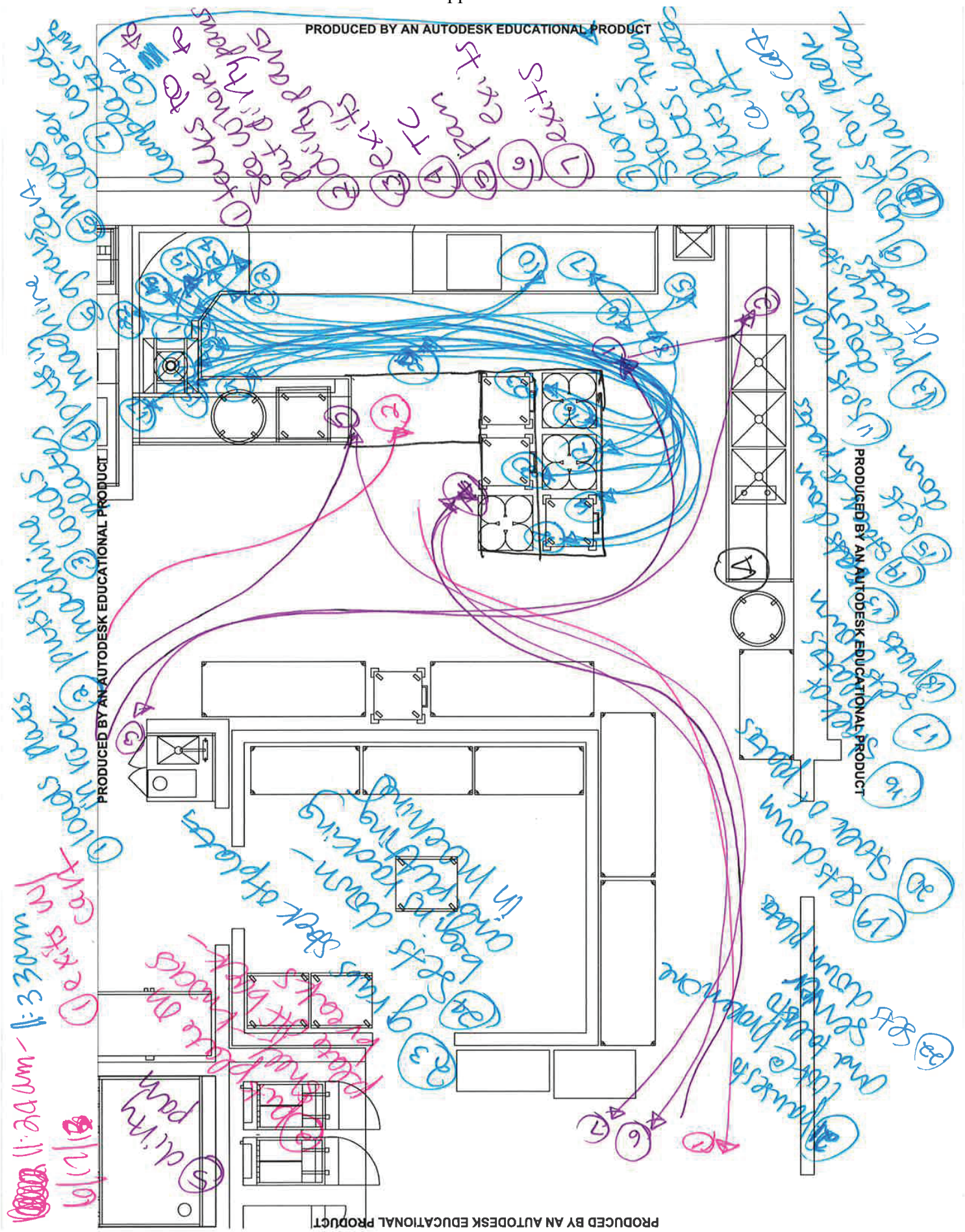
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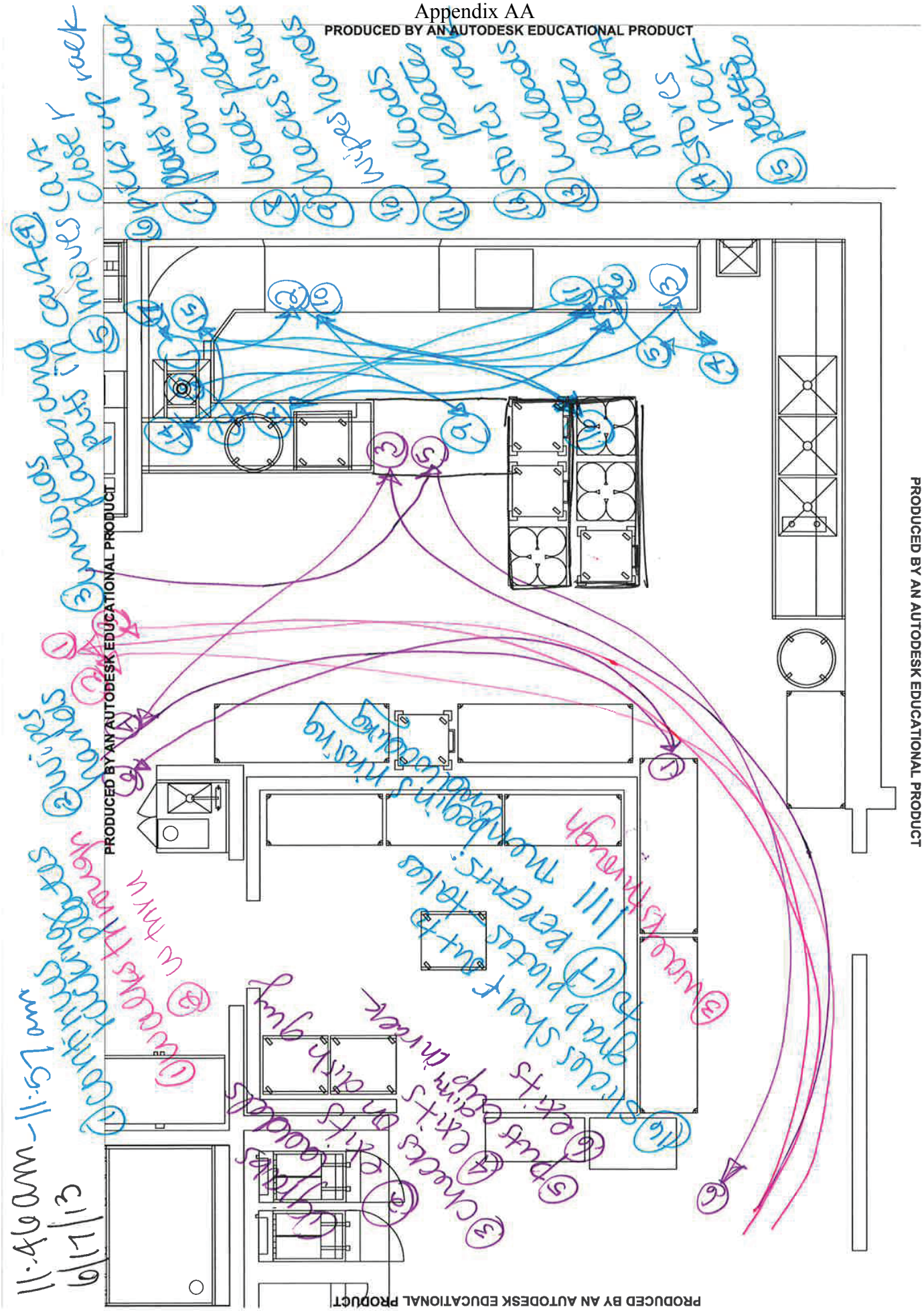

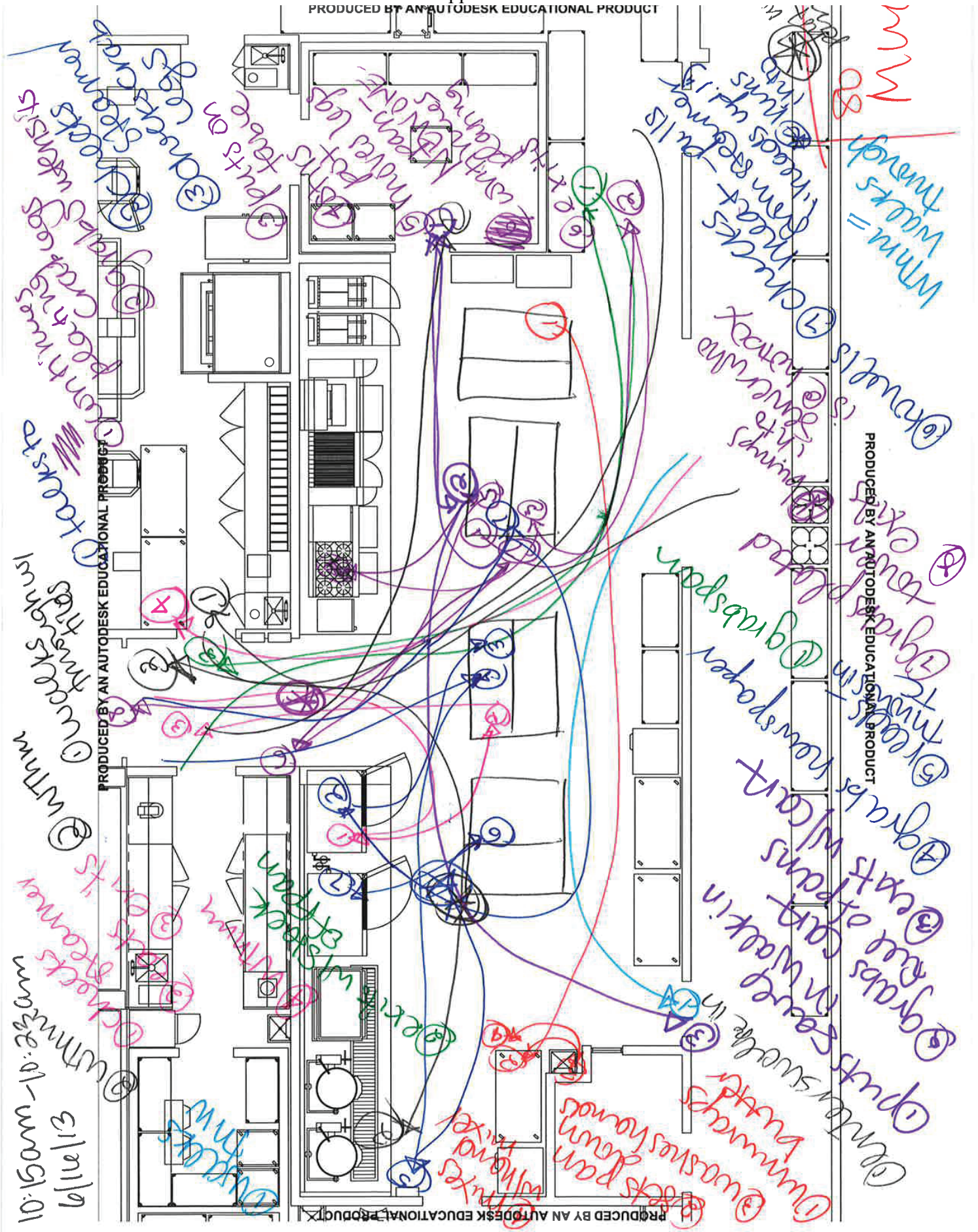
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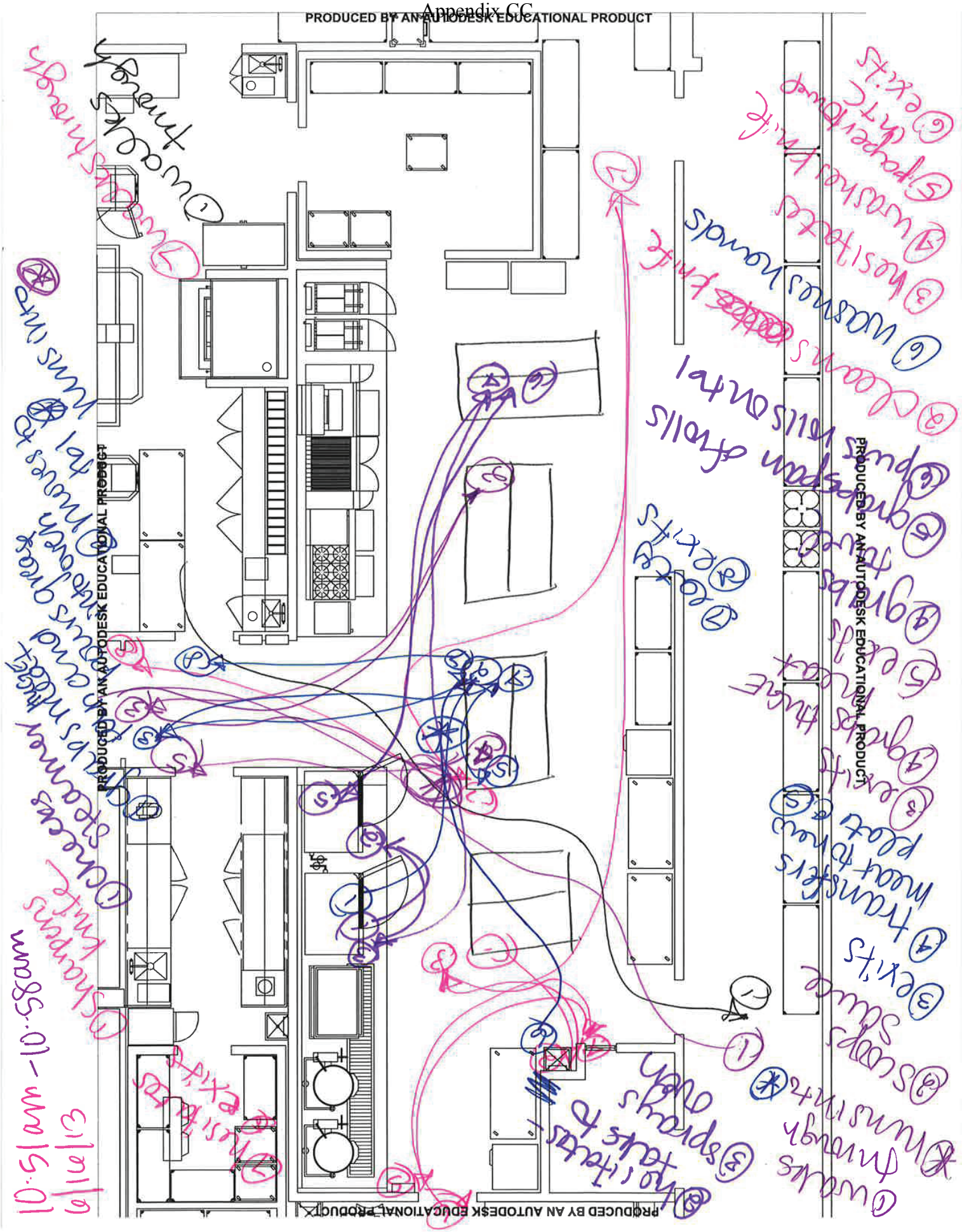
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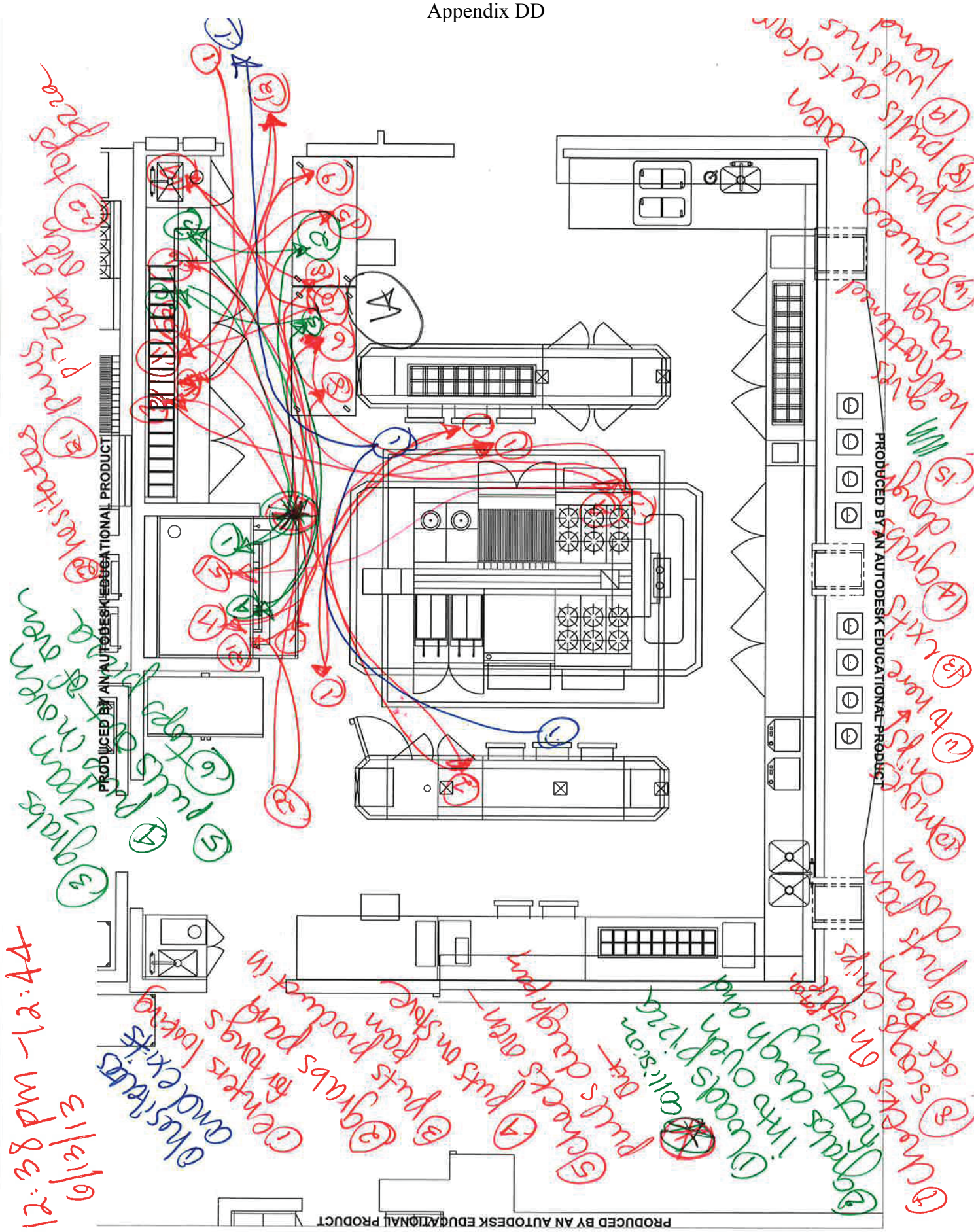
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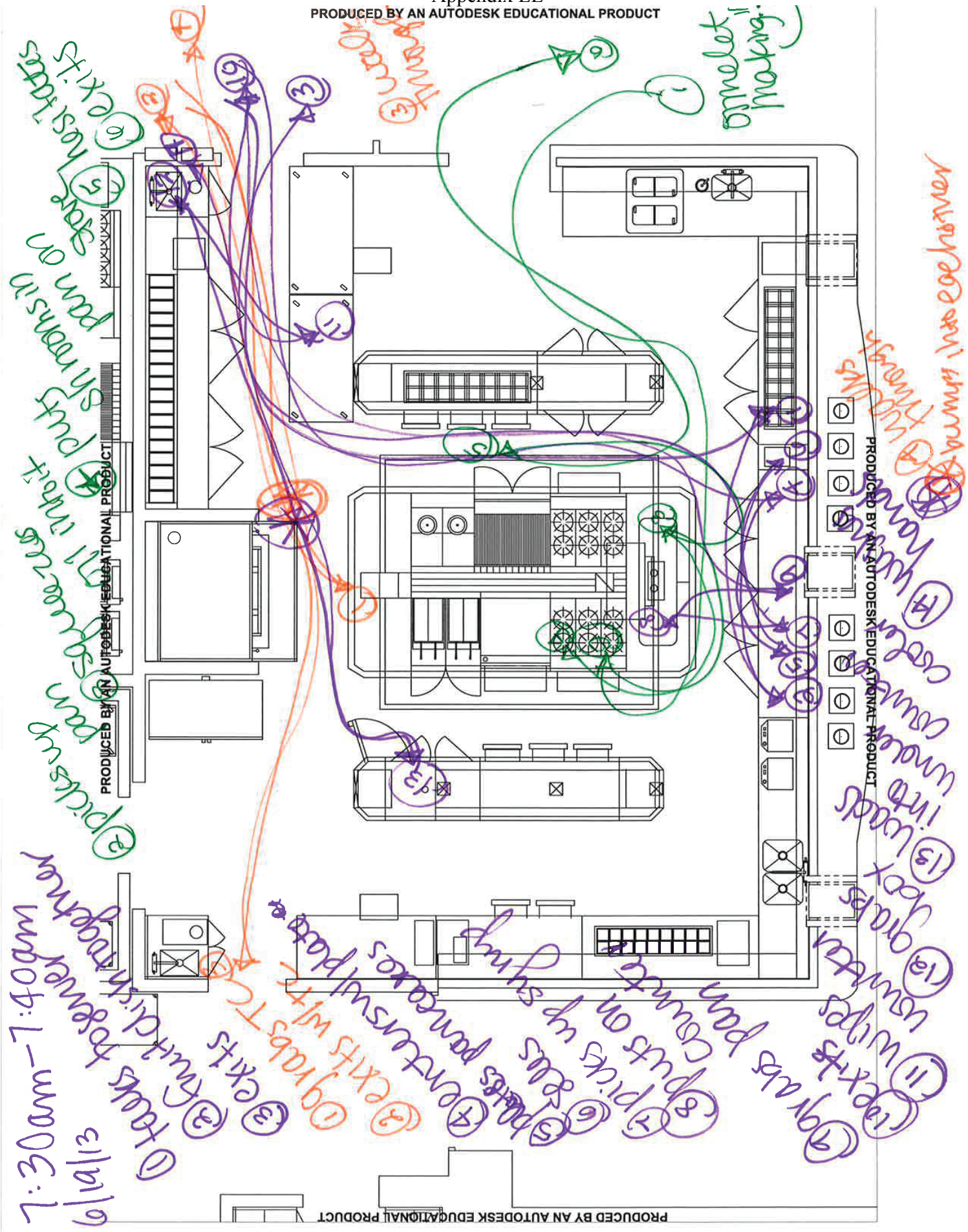
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