Growing Plant-Rich Dining by Design: Co-Designing Behavior Change Strategies to Encourage Sustainable Food Choices

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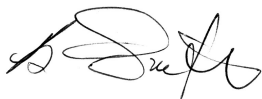
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EQUITY AND ACCESS: FOOD SYSTEMS

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Abstract

Widespread adoption of plant-rich diets is a key climate change mitigation strategy. Restaurants are one of many environments where diets must shift toward more sustainable directions. Researchers have studied behavior change strategies in these contexts, including information provision and choice architecture. However, few have been tested in the field, and the literature has under-addressed the barriers restaurants face in implementation. Additionally, the designs of these interventions have rarely been informed by the restaurant stakeholders who will be enacting the intervention, nor by the customers affected by the intervention, which may lower the probability of its acceptance and success. Integrative designers are uniquely positioned to address these shortcomings. They examine broader systems at play, identify opportunities to change the system, skillfully create artifacts to support those opportunities, and deeply collaborate with stakeholders throughout research and implementation.

This work implemented a series of design interventions in collaboration with El Harissa, an independent restaurant in Ann Arbor, Michigan, to increase the selection of low-carbon, plant-rich dishes as a climate change mitigation measure. The design practitioner engaged with the restaurant's owners, staff, and customers in a five-phase design process integrating Design for Sustainable Behavior and Co-Design. Three behavior change strategies were integrated into custom menu materials: descriptive environmental messaging, carbon labeling, and taste-forward menu descriptions.

Preliminary results from the two-week piloting of these materials indicate that the average emissions per sold dish declined by two percent compared to the control period. In-field observations by the design practitioner and restaurant manager found that the carbon labels prompted positive conversations between customers and staff, highlighting the synergies between quantitative and interpersonal approaches to shift customer behavior. Potential future applications of this design process include additional iterations of carbon labeling visual systems and exploring additional behavior change strategies to support sustainable food choices in restaurant contexts.

Keywords

Plant-rich diets

Co-Design

Design for Sustainable Behaviors

Carbon labeling

Descriptive environmental messaging

Climate change

Restaurant industry

Sustainable food choices

Contents

Acknowledgements

The Impacts of COVID-19 on this Project

This work occurred between September 2021 through April 2022, when the United States endured the Delta and Omicron variant waves of the COVID-19 pandemic. The shock of the pandemic has dissipated for many Americans after two years of masking up and social distancing. However, its disruption of the restaurant industry and my collaborator, El Harissa, impacted the approach of this project. Inviting Ann Arbor-area restaurants to engage in this project was a tall order on top of the many stresses imposed by the pandemic. Reduced hours, staff shortages, and a rapid shift to takeout-only service certainly justify an owner's hesitancy to change even more elements of their business, even if promoting plant-rich dining aligns with their values. During this project's duration, El Harissa maintained its commitment to safety by continuing its takeout-only ordering model, requiring all staff and guests to wear masks, and closing during critical variant waves to reduce the spread. Following their lead, I developed virtual interview protocols and collaboration tools to learn from El Harissa's customers and staff and focused my design interventions on the takeout ordering experience. Though I had the best intentions, incorporating staff perspectives into the early stages of the research and design process was limited due to staff illness and scheduling conflicts.

It can be easy to lament what *could have been* without the constraints of COVID-19. However, I have learned that Co-Design is not only composed of grand, in-person workshops but many on-the-fly collaborative moments. COVID-19 ushered in a willingness to hop on Zoom with Yusef Houamed, El Harissa's manager, with short notice to discuss how to calculate the carbon emissions of El Harissa's dishes. Co-Design also shows up in a messy Google Doc where we composed numerous iterations of the best taste-forward descriptions of their dishes. These moments are something that I aim to cultivate and celebrate in my future design work.

At the time of writing, Dr. Anthony Fauci, President Biden's chief medical adviser and the director of the National Institute of Allergy and Infectious Diseases, told CNN that the United States is entering a transitional phase of the pandemic, one where we are "hopefully headed toward more of a control where you can actually get back to some form of normality without total disruption of society, economically, socially, school-wise, etc." (Thomas and Goodman 2022). As we return to dining spaces, we cannot return to business-as-usual with our food choices. This project begins to imagine what the alternative might be.

Key Terms

A2ZERO: The City of Ann Arbor, Michigan's community-wide plan to achieve carbon neutrality by 2030.

Ann Arbor Office of Sustainability and Innovations (OSI): The department within the Ann Arbor, Michigan city government that creates and implements programs and policies to cultivate a sustainable and equitable community, such as A²ZERO.

Anthropogenic: Refers to environmental changes that are caused or influenced by humans, either directly or indirectly.

Carbon dioxide equivalents (kg CO2eq): A unit representing the mass of any greenhouse gas, standardized into terms of carbon dioxide to account for the variation in global warming potential.

Carbon Labeling: Use of symbols or other graphic representations to communicate a product or service's total life cycle emissions.

Carbon Neutrality: Refers to reducing an entity's greenhouse gas emissions—whether from an individual, organization, or otherwise—to be less than or equal to the quantity of emissions absorbed through natural processes (i.e., through forests and trees).

Co-Design: Refers to actors trained in different disciplines, in design or otherwise, who contribute to the design process and produce new knowledge.

Descriptive Environmental Messaging: Use of simple language to inform consumers about the environmental impact of a given product.

Design for Sustainable Behavior (DfSB): A multi-phase methodology that addresses the environmental impacts of a product or system's use phase and moves from understanding the users in context to identifying appropriate behavioral strategies to designing and testing solutions.

El Harissa: The North African and Mediterranean restaurant based in Ann Arbor, Michigan that served as the context and partnership for this research.

Enteric Fermentation: A food decomposition process that occurs in the digestive systems of ruminant animals, such as cows and sheep, producing a significant amount of methane, a highly potent greenhouse gas.

Flexitarian Diet: a predominantly plant-based diet complemented with modest amounts of animal foods.

Greenhouse Gas (GHG) Emissions: Gasses that concentrate in the Earth's atmosphere and trap heat. The most common GHG emissions from human sources include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

Global Warming Potential (GWP): A standard unit of measure that compares greenhouse gasses with varying capacities to trap heat and remain in the atmosphere. For example, carbon dioxide has a GWP of 1 and is used as the reference gas, while methane has a GWP of about 28 due to its ability to trap much more heat than carbon dioxide.

Plant-rich Diet: Diets that emphasize the consumption of minimally processed fruits and vegetables and derive protein from nuts, legumes, and seeds.

Vegan Diet: Diets that exclude all animal products.

Vegetarian Diet: Diets that exclude meat but include some animal products such as dairy and eggs.

Figures

Tables

SOUPS & STEWS

Moroccan Lentil Soup — 7.5 / 13
Nurturing and filling. Slowly simmered red and green lentils with fragrant spices, fresh herbs, kale, and mirepoix vegetables.

Lablabi — 11
A robust and bright chickpea stew with lentils, kale, onions, and loads of warm spices. Our spin on a Tunisian classic.

Maghrebi Chili — 8 / 13
Ground beef seasoned with Harissa spices and slowly cooked with chickpeas, lentils, black beans, peppers, and loads of vegetables.

parmesan, ricotta, and mozzarella. — 10.5
contains egg, dairy, gluten

Lasagne Verde — 10.5
Loaded with vegetables, all hand-chopped and sauteed to perfection, layered with homemade tomato basil sauce, parmesan, ricotta, and mozzarella. contains egg, dairy, gluten

Bacalao Fish Pie — 10
A Maritime Shepherd's Pie! A base of salt cod, tilapia, sardine, carrots, and leeks topped with spiced whipped potatoes. contains egg

Mujadara Rice
A Levantine staple of spiced green lentils rice. Ours is adorned with carefully cara golden onions for a touch of savory-sw

Merguez Meatballs
Inspired by the Maghrebi sausage and beef meatballs are hand-roll and herbs and coated with a th Served with saffron rice or co

Berber Terrine du
Ground chicken with pot and fenugreek baked in Served with a citrusy c contains egg

SIDES

Saffron Rice — 2

Golden Couscous — 2

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INTRODUCTION

The food system represents 26% of all anthropogenic, or human-caused, greenhouse gas (GHG) emissions, half of which arise from livestock production, which emits significantly higher greenhouse gasses than plant-sourced foods (Poore and Nemecek 2018). Widespread adoption of reduced-meat diets, such as a plant-rich diet, is a crucial climate change mitigation strategy (Bajzelj et al. 2014; Springmann et al. 2018; Hedenus, Wirsenius, and Johansson 2014). Plant-rich or plant-based diets emphasize the consumption of minimally processed

fruits and vegetables and derive protein from nuts, legumes, and seeds. Definitions of this diet range from excluding all animal products, such as a vegan diet (Ostfeld 2017), to incorporating limited amounts of meat and animal products, such as a vegetarian or flexitarian diet (Attwood et al. 2020; Lea, Crawford, and Worsley 2006; Pohjolainen, Vinnari, and Jokinen 2015). In these cases, animal products are incorporated as an accent to a meal rather than the focal point of the plate (McManus 2020; Bilow 2015). The savings that arise from transitioning to a plant-rich diet are immense, considering that dried beans emit 106 and 13 times fewer GHG emissions than the production of beef and chicken, respectively (Heller et al. 2018).

However, moving toward more sustainable diets is more complex than simply swapping meat for legumes. Culinary traditions, lack of awareness between food choices and emissions, habits, cultural norms, social pressures, taste preferences, cooking skills, allergies, nutrition and agricultural policies, and other influences can both impede and enable behavior change (Hartmann and Siegrist 2017; Sanchez-Sabate and Sabaté 2019; Sanchez-Sabate, Badilla-Briones, and Sabaté 2019; Piazza et al. 2015; Macdiarmid, Douglas, and Campbell 2016; Smith 2019; Moss 2013, 231; Wellesley, Happer, and Froggatt 2015). These intersecting influences help characterize this necessary dietary transition as a *wicked problem*: a complex, multi-causal issue that cannot be comprehensively understood or solved, only "re-solved" again and again over time (Rittel and Webber 1973). There is no endpoint to this problem, as humans will continue to make food choices as long as humanity exists, and the influences on decision-making will continue to change. The present levels of meat-centric diets in the United States are symptoms of other wicked problems, such as federal agricultural support programs for commodity crops (i.e., corn and soy) resulting in underpriced, surplus feed and more affordable meat (Smith 2019). Additionally, every implemented solution to a wicked problem is a "one-shot operation" and can result in undesired consequences that cannot be undone

(Rittel and Weber 1973). For example, Alexandria Ocasio-Cortez's comments addressing factory farming soon after co-sponsoring the Green New Deal in 2019 led to conservatives seizing the hamburger as a symbol for rejecting the climate legislation (Houck 2019).

The restaurant industry provides a worthy context for exploring this wicked problem. First, restaurant patronage is vast. Out-of-home food sales in 2019 in the United States represented over half of all food spending (USDA ERS 2020). Though 2020 sales had a significant drop due to the COVID-19 pandemic, its sales exceeded each year before 2015 (US Census Bureau 2021), and 2021 restaurant sales have begun to recover with a $121 billion jump from 2020 (National Restaurant Association 2022). Second, it has been demonstrated that restaurant customers are more likely to consume meat more often and in larger quantities than at home (Biermann and Rau 2020; Horgan et al. 2019). Third, restaurants can shape customer food choices in more sustainable directions with each visit. Restaurants can develop tasty plant-rich options, design menus that incorporate behavior change strategies, and become educational spaces for meat-eating customers (Cai, Ding, and Legendre 2021). Customers who interact with these restaurants can then translate their new behaviors to decision-making at home and in other food environments (Attwood et al. 2020).

Scholars in sustainable food consumption, behavioral science, environmental psychology, and other fields have studied interventions to lower meat consumption in restaurants and other foodservice contexts. These studies range from simply providing information to customers about the impacts of their food choices, manipulating the presentation of options on a menu, and removing meat options on an occasional or permanent basis. However, much of this research has only occurred either as online or lab-based studies (Blondin et al. 2022; Osman and Thornton 2019; Attwood, Chesworth, and Parkin 2020; Vaan, Steen, and Müller 2019; Krpan and Houtsma 2020; Bacon and Krpan 2018) or has been implemented in university dining hall settings (Visschers

and Siegrist 2015; Turnwald, Boles, and Crum 2017; Garnett et al. 2019; 2020; Friis et al. 2017; Brunner et al. 2018; Spencer et al. 2018). The few who have implemented interventions as field experiments in non-university affiliated restaurant contexts are promising (Sparkman et al. 2020; Çoker et al. 2022; Filimonau et al. 2017), but they document barriers with intervention visibility, comprehension, relevance to customers, and implementation constraints from restaurant research partners.

Herbert Simon, American social scientist and author of *The Sciences of the Artificial*, asserts that "the natural sciences are concerned with how things are," whereas "design, on the other hand, is concerned with how things ought to be" (Simon 1996, 114). The design discipline is uniquely positioned to address this problem by translating between experimental studies and real-world implementation. From a project's problem definition phases, designers have the capacity to apply human-centered approaches to observe the factors influencing customer and staff behavior in a given restaurant context and identify potential areas to intervene in the system. As the project progresses, designers have the form-giving skills to develop services and tangible artifacts to support the intervention, whether it is a visual system to communicate greenhouse gas emissions, menus and food displays that manipulate hierarchy to guide customer choices, or a series of talking points for staff to recommend plant-rich dishes. Throughout the research and design process, design practitioners cultivate collaborations with multiple disciplines and stakeholders. In the case of restaurant contexts, designers can integrate the perspectives of owners, managers, staff, and customers to determine the most appropriate behavior change strategies for that context and lead these stakeholders through an iterative design and implementation process to make the change a reality, which is easier said than done.

To demonstrate the value of integrative design in translating sustainable food behavior research into real-world restaurant settings, I partnered with El Harissa, a North African and Mediterranean restaurant based in Ann Arbor, Michigan, to research, design, and implement strategies to increase the selection of plant-rich dishes and decrease greenhouse gas emissions associated with meat consumption. Two design approaches were integrated to guide this design inquiry: Design for Sustainable Behaviors and Co-Design. Design for Sustainable Behaviors (DfSB) is a multi-phase methodology that addresses the environmental impacts of a product or system's use phase and moves from understanding the users in context to identifying appropriate behavioral strategies to designing and testing solutions (Lilley and Wilson 2017). Co-Design refers to actors trained in different disciplines, in design or otherwise, who come together to contribute to the design process and produce new knowledge (Kleinsmann and Valkenburg 2008).

The five phases of DfSB provided structure to this exploration, and Co-Design supplemented each DFSB phase to leverage the perspectives of El Harissa's manager, staff members, and customers. In the first phase, *Understanding Users in Context*, I conducted observations in the restaurant, designed two virtual activities for customers to express their ideal plant-rich dish, and interviewed customers and El Harissa's manager to identify the factors that influence food choices in this specific context. In the second and third phases, *Specifying the Target Behavior* and *Selecting Intervention Strategies*, I employed journey mapping, a service design method, to identify opportunities for intervention. In phase 4, *Produce Intervention Solutions*, I worked closely with El Harissa's manager to co-design a brand-new menu board, a set of deli display cards, and an informational flyer that integrated three behavioral intervention strategies: carbon labeling, descriptive environmental messaging, and appealing menu language, as shown in Figure 1. In phase 5, *Evaluation*, preliminary results

Figure 1. *Behavior change intervention materials implemented inside El Harissa.*

indicate that customers used the carbon labels about 25% of the time to make lower carbon choices when they were understood. Additionally, average emissions per dish sold decreased by 2% during the two-week implementation period compared to the preceding two weeks, while revenue remained relatively stable. Though small, these results indicate the promise of carbon labeling in shifting customer selections.

The findings and value of this project lie within its entire process, not just the observable behavior change that resulted from the intervention's implementation. The observation sessions and interviews with customers contextualized the barriers to selecting plant-rich food choices discussed in the existing literature. Initial interviews and ongoing conversations with El Harissa's manager revealed additional barriers to promoting plant-rich choices in restaurants, which is less explored than customer behavior in the literature. Insights from that first phase yielded additional intervention opportunities that El Harissa can explore in the future. Co-Designing the tangible intervention materials—calculating the carbon footprint of each dish and crafting taste-forward menu descriptions—brought new skills to the manager's practices and could influence how El Harissa develops and describes future dishes. This unique approach could also offer design practitioners new methods and intervention considerations for this wicked problem.

Problem Statement and Research Aims

This project seeks to shift the status quo of animal product-centric diets to low-carbon, plant-rich diets by collaboratively designing and implementing behavior change strategies in a local restaurant context. It aims to demonstrate the value of integrative design methods in the transition to plant-rich diets. It also aims to enhance the Design for Sustainable Behavior (DfSB) subfield with Co-Design methods to integrate stakeholder voices. El Harissa provided a means for exploring this wicked problem, yet the project's process, results, and implications are relevant to many foodservice settings seeking to increase plant-rich dining and mitigate their food-related carbon footprint.

The below overarching research question guided this inquiry:

> *How might Design for Sustainable Behavior and Co-Design be used as integrative design methods to develop and implement behavior change strategies to reduce meat consumption in an independent restaurant, such as El Harissa?*

Additional research questions and objectives cascaded from the above research question for Phase 1, *Understand Users in Context*, and Phase 5, *Evaluation*. Phase 1 aimed to identify the factors that influence the development and selection of plant-rich and meat-based dishes from the perspectives of El Harissa and its customers. From the restaurant's perspective, I aimed to understand:

1. How their menu is developed and what considerations are taken into account;

2. Their understanding of the environmental impact of animal products and how knowing this affects what they offer;

3. Their perspective on plant-rich diets and dishes;

4. The barriers and enablers in creating and promoting plant-rich dishes in their restaurant; and

5. What changes they might be willing to make to encourage plant-rich choices.

From the customer's perspective, I aimed to understand:

1. Customers' decision-making process and considerations when ordering a meal at El Harissa;

2. Customer understanding of the environmental impact of animal products and how this information affects what they select in restaurant settings;

3. Customer experience with and perspectives on plant-rich diets;

4. The barriers and enablers for selecting plant-rich dishes in restaurant settings; and

5. Attitudes towards other sustainability initiatives that El Harissa has implemented.

In Phase 5, *Evaluation*, I assessed the design intervention by employing the following framework questions from DfSB (Lilley and Wilson 2017):

1. Does the design intervention function for the specified context?

2. Is the user's behavior change sustainable (ecologically, socially, economically)?

3. Has the user's behavior changed as a consequence of the design intervention? Has the intervention changed the habitual behavior of the user?

Research Context and Stakeholders: El Harissa

For this thesis project, I collaborated with Yusef Houamed, manager of El Harissa. Yusef provided his expertise in operating an independent, family-owned restaurant that strives to be a fixture in the community, educate its customers through food, and model more sustainable business practices. His interest in making change in the local restaurant industry, combined with my skills and knowledge in design, created an exciting partnership to explore how collaborative design approaches could shift consumer food choices in a more sustainable direction.

El Harissa opened its doors in 2013, founded by Khaled Houamed and Susan Thomas, Yusef's parents. Their deli case is filled with distinct, Tunisian-influenced, healthy dishes that are pre-packaged and ready for carryout. While the restaurant's interior has been closed for dine-in since the start of the COVID-19 pandemic, customers can opt to dine outside on the restaurant's patio in the warmer months. The business also features a gelato counter and a boutique market. The design interventions produced in this project were focused on El Harissa's brick and mortar location, shown in Figure 2. However, the discoveries Yusef and I made could span into the businesses' other endeavors, such as catering, their weekly pop-up in two University of Michigan union dining locations, and wholesale contracts with local food businesses.

This project with El Harissa connects with the broader effort that the City of Ann Arbor, Michigan, is engaging in to encourage plant-rich diets. In June 2020, the City adopted A2ZERO, a community-wide carbon neutrality plan developed by the Office of Sustainability and Innovations (OSI), community stakeholders, partner organizations, and technical advisors (Office of Sustainability and Innovations 2020). In simplest terms, carbon neutrality refers to reducing an entity's greenhouse gas emissions—whether from an individual, organization,

Figure 2. *El Harissa Restaurant, exterior and interior.*

or otherwise—to be less than or equal to the quantity of emissions absorbed through natural processes (i.e., through forests and trees) (UNFCCC 2021). For Ann Arbor, this means eliminating the 2.1 million metric tons of greenhouse gasses emitted by the community annually (City of Ann Arbor 2020). The plan aims to achieve carbon neutrality by 2030 and outlines seven overarching strategies with 44 actions spanning renewable energy, energy efficiency, and transportation (City of Ann Arbor, 2020). The plan puts forth an action to support plant-rich diets, recognizing the food sector's impact on climate change. The action aims to increase community awareness of the environmental impacts of their food choices and increase the consideration of those impacts when making food decisions (City of Ann Arbor, 2020). The action incorporates many community stakeholders, with local chefs and restaurants being critical pieces of this puzzle.

Thesis Document Overview

In this thesis, I begin the *Contextual Review* by discussing the wicked problem of meat and animal product consumption's impacts on climate change, the barriers to adopting plant-rich diets, and how restaurant contexts reinforce those barriers. I continue the *Contextual Review* by discussing the range of behavior change interventions in the literature to encourage sustainable food choices in dining contexts. I then describe the Design for Sustainable Behavior and Co-Design approaches incorporated into my design process. *Methodology* defines the theory of methods, the nature of my partnership with El Harissa, the phases of the research, descriptions of the operationalized methods, and ethical considerations. *Results* describes the data collected within each phase and how the findings addressed phase-specific research questions and informed subsequent design decisions. *Discussion* highlights the critical findings from each phase, reflects on how the integrative design approach addresses the broader research question, and discusses the value of the project. *Conclusion and Future Work* summarize the findings and significance of the thesis and describe the continuation of the partnership with El Harissa and recommendations for additional research.

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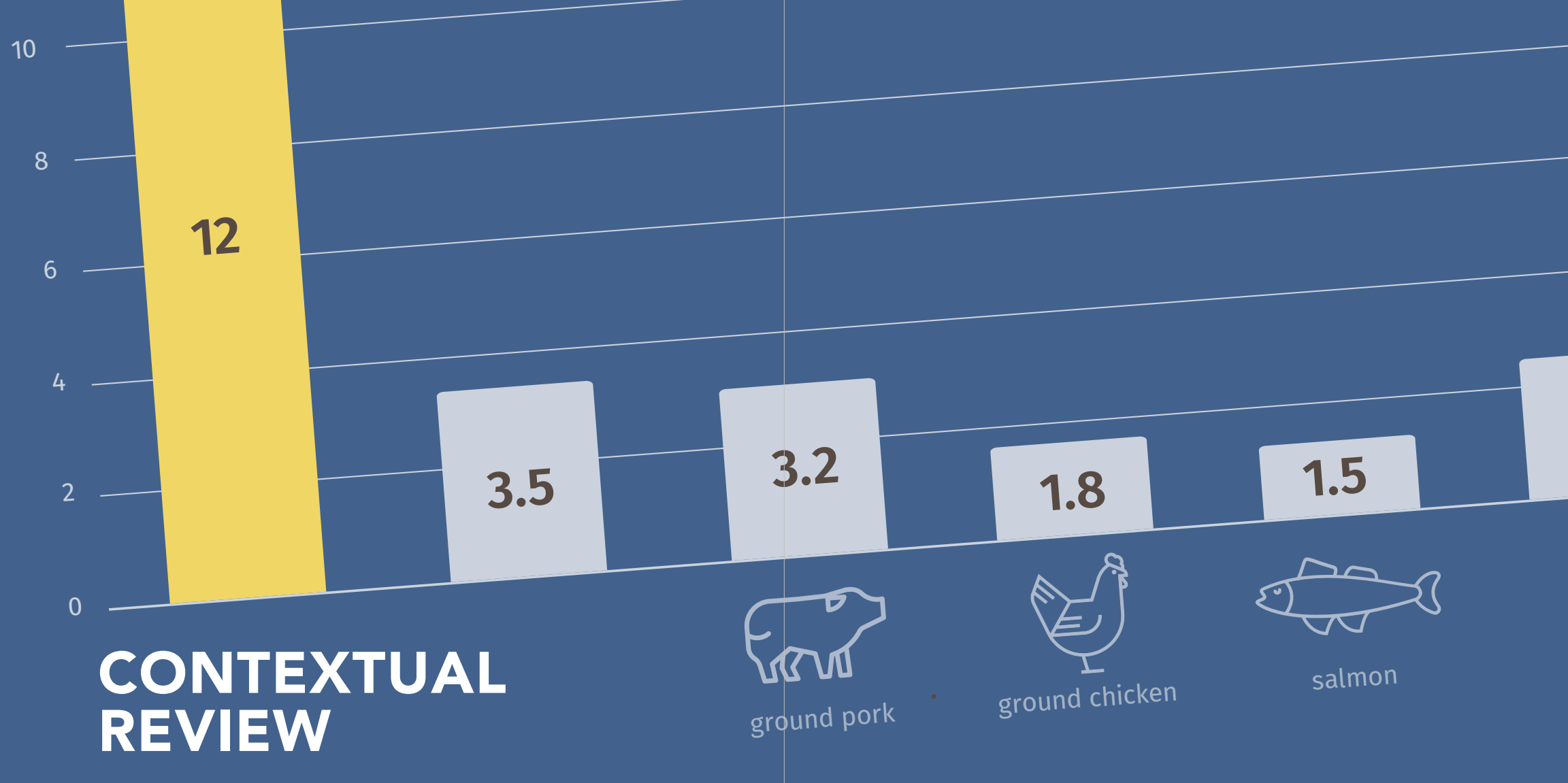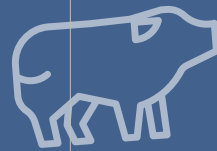
ground pork

ground chicken

salmon

CONTEXTUAL REVIEW

Problem Definition

Meat Consumption and its Connection to Climate Change

Climate change and its increasingly devastating effects are a reality. In simplest terms, the phenomenon is driven by the disproportionate levels of greenhouse gasses (GHG) emitted by human activities such

as transportation, energy, and food production, which trap heat in the atmosphere and increase the average global temperature, resulting in significant, long-term variations in average weather patterns (Denchak and Turrentine 2021). The world has experienced the warmest average temperatures on record over the last decade, with the warmest six years since 2015 (World Meteorological Organization 2021). This increased heat has ushered in more frequent and extreme storms, flooding, heatwaves, droughts, and wildfires, impacting communities and ecosystems worldwide (Otto et al. 2017; Jentsch and Beierkuhnlein 2008; Doherty and Clayton 2011).

Climate change is expected to worsen if we fail to mitigate GHG emissions sufficiently. Global average temperatures reached 1°C above pre-industrial levels in 2017 (IPCC 2018). In a business-as-usual scenario, it is estimated that we are on track for a 2°C rise over pre-industrial levels by about 2043 (Hausfather 2020), which is estimated to have widespread, severe impacts, such as extreme temperature spikes,

declining biodiversity, and declining crop yields (Lieberman 2021). The 2018 Intergovernmental Panel on Climate Change Special Report has defined a 1.5°C rise above pre-industrial levels as a "buffer zone" for staving off most of the catastrophic effects (IPCC 2018). Limiting warming to 1.5°C would expose 420 million fewer people to extreme heatwaves, 61 million fewer people exposed to drought, and 50% fewer people affected by climate-change-induced water stress than a 2°C rise (Buis 2019). To have a minimal overshoot of that 1.5°C threshold, global net anthropogenic (human-caused) GHG emissions must decline by 45% from 2010 levels by 2030 and reach net zero by 2050 (IPCC 2018). Rapid change in every sector is required.

The food system and meat consumption are no exception to this need for change. The food sector's supply chain contributes 26% of all anthropogenic GHG emissions, half of which originate from livestock production (Poore and Nemecek 2018), as illustrated in red portions of the stacked bar chart in Figure 3. Emissions from the production of livestock arise from multiple sources. These emissions include GHGs beyond carbon dioxide, such as nitrous oxide and methane (Rojas-Downing et al. 2017), both of which have a higher global warming potential (GWP) than carbon dioxide (i.e., the ability to trap heat in the atmosphere (Durkee 2006)). Emissions arising from pasture

GLOBAL GREENHOUSE GAS EMISSIONS
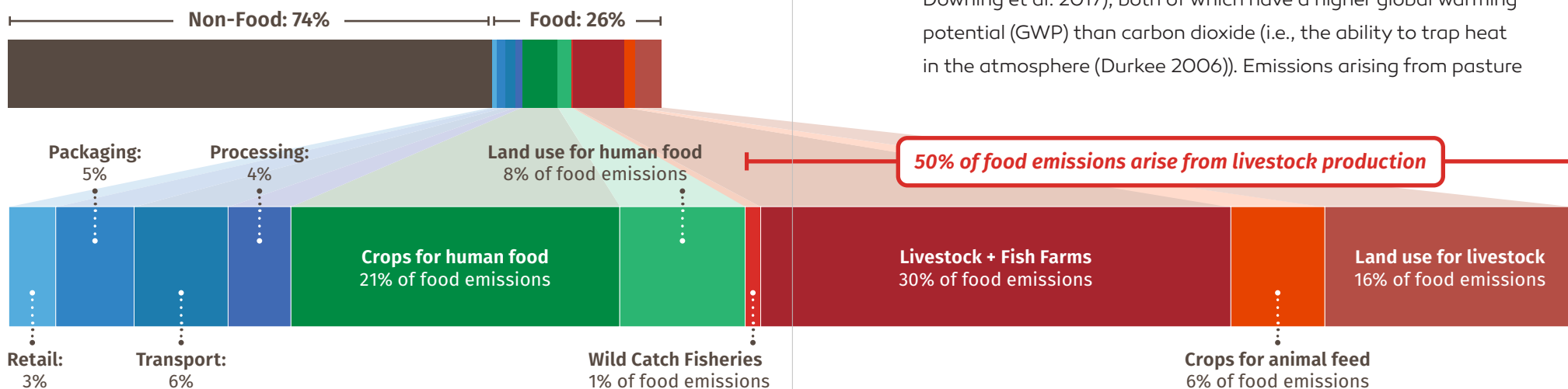
Figure 3. *Food-Related Global Greenhouse Gas Emissions. Adapted from Ritchie and Roser (2020) with data from Poore and Nemecek (2018).*

Figure 4. *Greenhouse gas levels emitted from the production of common protein-rich animal-sourced and plant-sourced foods. Adapted from Heller, Keoleian, and Willett (2013).*

and farmland expansion to accommodate livestock production, representing 16% of food emissions, as seen in Figure 3, result from the reduced capacity for that converted land—typically former forest land—to sequester carbon in the soil (Rojas-Downing et al. 2017). Crop production for animal feed results in increased carbon dioxide, nitrous oxide, and methane due to synthetic fertilizer and manure production and application (Rojas-Downing et al. 2017). One of the largest sources of methane in the world (44%) arises from enteric fermentation (Gerber et al. 2013), colloquially known as "cow burps," which results from the digestive process of ruminant animals (e.g., cows, sheep, and goats) (Rojas-Downing et al. 2017). Transportation and processing are relatively minor contributors to total livestock emissions (Gerber et al. 2013).

Widespread adoption of plant-rich diets and an overall reduction in animal-sourced foods can significantly reduce the GHG emissions described above and yield climate change mitigation benefits. Willet et al. (2019) estimate that while improving food production practices could reduce agricultural GHG emissions by 10% in 2050, increased adoption of plant-rich diets could reduce these emissions by 80%. This is because animal products, even when they are produced using low-impact methods, largely outweigh the average impacts of plant proteins in terms of GHG emissions and other environmental impacts such as land and water use (Poore and Nemecek 2018). Figure 4 illustrates how livestock emissions vary by animal yet significantly outweigh the emissions of plant foods, even when protein levels are constant. These food sources are compared in terms of kilograms of

carbon dioxide equivalents (kg CO₂eq), which represent the mass of greenhouse gasses emitted, standardized into terms of carbon dioxide to account for the variation in global warming potential of various GHGs (Heller, Keoleian, and Willett 2013). Per 100 grams of protein, emissions arising from beef largely outweigh any other protein source at 12 kg CO₂eq. Even still, pork, chicken, and salmon emit 3.2 kg CO₂eq, 1.8 kg CO₂eq, and 1.5 kg CO₂eq, respectively, a much larger footprint than dry beans, which emit only 0.43 kg CO₂eq per 100 grams of protein (Heller, Keoleian, and Willett 2013)[1]. Additionally, other non-protein plant foods also produce minimal emissions compared to animal products. For example, the production of a kilogram of cauliflower emits 0.36 kg CO₂eq, 21 times fewer emissions than the production of cheese derived from cows, which emits 7.61 kg CO₂eq per kilogram (Heller et al. 2018), highlighting the significant impact of moving away from animal-sourced foods.

A complete transition to veganism is not required to yield significant benefits. Flexitarianism, a predominantly plant-based diet complemented with modest amounts of animal foods (Dagevos 2021), can effectively reduce emissions. For instance, by 2050, if the average global diet were limited to one serving of red meat per week and a half serving of white meat per day, food-related GHG emissions would fall about 50% (Eker, Reese, and Obersteiner 2019). In the US, reducing consumption of beef and other animal-sourced foods by 90% and 50%, respectively, would eliminate over 2 billion tons of GHG emissions by 2030, about the equivalent of taking half the world's cars out of operation for a year (Heller, Keoleian, and Rose 2020).

[1] To convert a non-carbon dioxide GHG to a carbon dioxide equivalent, one needs to multiply the mass of the GHG by its global warming potential. For example, methane, largely emitted from enteric fermentation, has a global warming potential about 28 times higher than carbon dioxide. Nitrous oxide, emitted from manure and fertilizer production and application, has a global warming potential about 265 times higher than carbon dioxide (US EPA 2016). One kilogram of methane emissions would be 28 kg CO₂eq and one kilogram of nitrous oxide would be 265 kg CO₂eq.

The Challenges to Behavior Change

Even though reducing meat consumption is one of the most effective actions individuals can take to reduce emissions (Mbow et al. 2019), there are many barriers to this necessary behavior change. First, consumers are largely unaware of or underestimate the links between food choices and GHG emissions (Hartmann and Siegrist 2017; Sanchez-Sabate and Sabaté 2019). A multi-country survey conducted by Chatham House, the London-based policy institute, found that only 29% of respondents identified livestock as a significant contributor to climate change. In comparison, 64% cited transportation, despite that these sectors contribute roughly the same amount of emissions (Wellesley, Happer, and Froggatt 2015). Within the US, it was found that only 6% of consumers considered reducing meat consumption as an effective climate change mitigation strategy (de Boer, de Witt, and Aiking 2016). When consumers do make any connection between food systems and the environment, they typically attribute packaging, waste, and transportation as major contributors, yet these sources have relatively small impacts compared to livestock production (refer to Figure 3 for a comparison of these sources) (Campbell-Arvai 2015; Hoolohan et al. 2013; Lea and Worsley 2008; Tobler, Visschers, and Siegrist 2011).

However, simply providing information about livestock's contribution to climate change is not enough to change behavior. A series of Swedish focus groups found that awareness of meat consumption's impacts raised skepticism regarding the nuances of livestock production and whether changing their behavior was enough to have any impact (Collier et al. 2021). Additionally, consumers want more convincing evidence explaining how livestock is "bad for the environment," but at the same time, an overload of information can cause discomfort or disengagement (Collier et al. 2021). Even when consumers have sufficient evidence, ecological concerns have a weak influence on motivations to reduce meat consumption (Sanchez-Sabate and Sabaté 2019).

There are many other forces at play. In Western countries, meat-based diets are largely the norm and are embedded in culinary traditions, making it challenging to shift consumption patterns (Sanchez-Sabate, Badilla-Briones, and Sabaté 2019). Piazza et al. (2015) encapsulate rationalizations of meat-eating practices in their "4Ns:" that eating meat is *natural* and is derived from our evolution as humans, eating meat is *normal* and expected practice in civilized society, that eating meat is *necessary* to obtain enough protein and maintain one's health, and that eating meat is *nice* and many derive enjoyment from the taste of meat. Consumers face operational barriers on top of these larger norms and rationalizations, such as lacking culinary skills and time to prepare reduced-meat recipes (Macdiarmid, Douglas, and Campbell 2016; O'Keefe et al. 2016; Tucker 2014) and the perceived higher cost of plant-rich diets (Philips 2019).

The Role of Restaurants

Eating outside of the home, such as dining in a restaurant or ordering takeout, reinforces the above barriers and creates additional challenges to this dietary transition. In this context, the rationalization of *niceness* (Piazza et al. 2015) comes into stronger focus, as customers place greater emphasis on taste and treating oneself in the decision-making process over health and environmental considerations (Biermann and Rau 2020). In addition to taste, meat-eating and flexitarian customers choose to eat meat because they believe that it is prepared better than at home, that it requires less effort than preparing meat at home, and that restaurants have too few vegetarian alternatives available (Biermann and Rau 2020). Restaurant customers practicing or attempting to practice a plant-rich diet also struggle with the lack of vegetarian and vegan options with sufficient variety. On top of this, these customers frequently have to maintain

a level of willpower to resist the dominance of meat dishes on the menu and contend with social pressure and feelings of imposing their "alternative" diet on others (Franko 2017; Gallimore 2015).

The barriers US-based restaurant operators face in creating and promoting plant-rich dishes are not well-documented in scholarly literature. A scoping review by Fuster et al. (2021) identifies potential revenue decrease, customer acceptance, customer demands for unhealthy options, time constraints, limited recipes, food preparation skills, and kitchen space constraints as barriers that US restaurants face in the promotion of healthy eating. One could argue that "healthy eating" has some overlap with plant-rich diets. Blount's (2022) interviews with San Antonio barbeque restaurateurs had similar findings, which were documented in a local newspaper. According to restaurateurs, developing a vegetarian entree was not perceived to be a worthwhile effort as most customers intend to order meat. As restaurants do not see the demand, owners do not consider having a plant-rich option to be cost-effective. Additionally, to fully accommodate vegan and vegetarian clientele, restaurants would need to configure their kitchen space so that meat dishes do not contaminate plant-rich dishes (Blount 2022).

The relationship between restaurants and their customers parallels the *cycle of inertia* that Wellesley, Happer, and Froggatt (2015) have observed in governments attempting to intervene to reduce meat consumption levels, as illustrated in Figure 5a. In this cycle, fear of repercussions paired with low public awareness lessens the pressure to intervene. Little precedent for intervention, plus the resulting inaction, leads to low levels of awareness and perpetuates further inaction (Wellesley, Happer, and Froggatt 2015). Figure 5b illustrates this cycle of inertia for reducing meat consumption in a hypothetical restaurant context. Like the government cycle, a restaurant's fear of repercussions—lost revenue and upsetting customers—combined with low levels of customer awareness about the impacts of food choices
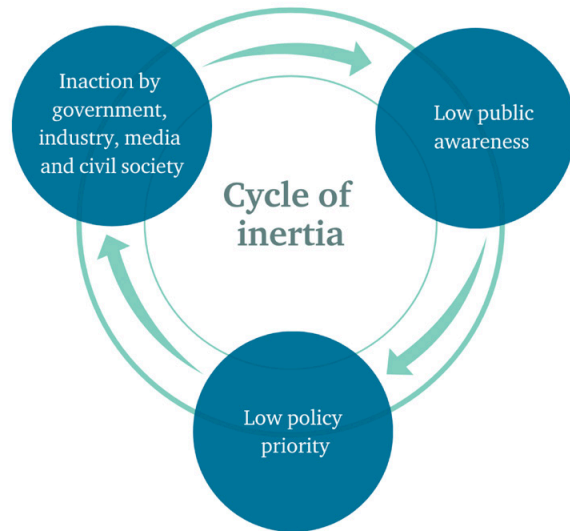
Figure 5a. Cycle of Inertia *preventing governments from intervening to reduce meat consumption, as illustrated by Wellesley, Happer, and Froggatt (2015).*
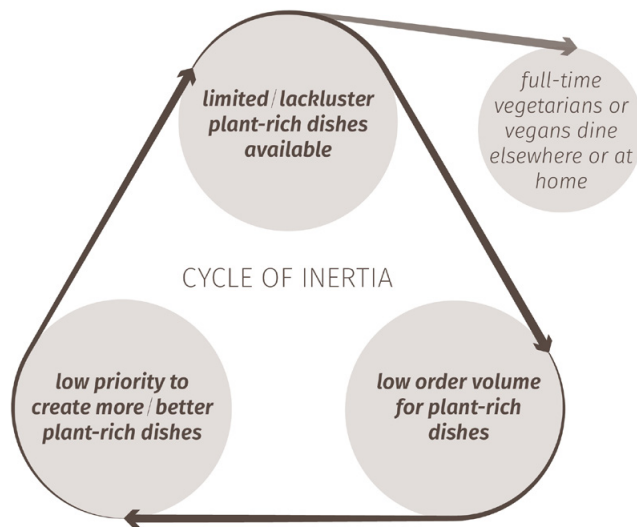
Figure 5b. Cycle of Inertia *representing restaurant and customer inaction to reduce meat consumption, adapted from Wellesley, Happer, and Froggatt (2015).*

on climate change dissuades restaurants from adding plant-rich dishes to their menu. The restaurant's low priority in exploring these changes reinforces a limited set of plant-rich options. Full-time omnivores will likely overlook these options, while customers trying to adopt a more plant-rich diet try the restaurant's lackluster vegetarian pasta option and never order it again or succumb to ordering a meat dish—lowering the restaurant's perceived demand for plant-rich dishes. Furthermore, potential customers who are firmly vegetarian or vegan may avoid a particular restaurant entirely because the restaurant does not have sufficient options, again reinforcing a perceived lack of demand.

Interventions to Reduce Meat Consumption

There are many strategies in the literature that restaurants can employ to encourage the consumption of plant-rich dishes beyond simply adding new dishes to the menu, as shown in Figure 6. Wellesley, Happer, and Froggatt (2015) use a framework to organize meat consumption reduction strategies to illustrate the variation in decision-making power between the person (user, consumer, or customer) and the designed intervention. The researchers discuss this framework for government-initiated interventions, but it translates well to restaurant-initiated interventions.

Informing interventions aim to empower customers with a greater understanding of the impacts of their food choices, but ultimately the customer has the most control in decision making. *Nudging* strategies exert more influence and steer behavior by manipulating choices, whether in a menu or physical environment, "without forbidding any options or significantly changing their economic incentives" (Thaler and Sunstein 2008, 6). *Forcing* interventions exert the most control, as they

edit food choices for the customer, whether through taxes, bans, and raising prices (Wellesley, Happer, and Froggatt 2015).

While several strategies are represented in Figure 6, El Harissa and I co-designed interventions incorporating *Descriptive Environmental Messaging*, *Symbolic Environmental Messaging*, and *Appealing Menu Language*, which will be detailed below. The selection of these strategies was influenced by the relevance and ease of implementation for El Harissa, how the design discipline would add value, and the project's timeframe. For example, while increasing the proportion of plant-rich dishes on a menu has been demonstrated as an effective strategy to increase plant-rich dish selection (Garnett et al. 2019; Attwood et al. 2020), implementation would require a disproportionate amount of

time and resources on El Harissa's part, while my design contributions would be less apparent. This decision-making process will be explained further in the Methodology section.

Descriptive Environmental Messaging

Descriptive environmental messaging uses simple language to inform consumers about the environmental impact of a given product, in this case, meat consumption's impact on climate change (Blondin et al. 2022). This messaging provides information that customers can consider when ordering, but it can also indirectly influence customers by activating positive associations they have with environmentally friendly attributes (Blondin et al. 2022). For example, foods with an

Inform
intervention provides information

Nudge
intervention manipulates options

Force
intervention removes options

Descriptive Environmental Messaging
(Blondin et al. 2022; Sparkman et al. 2020)

Symbolic Environmental Messaging (Carbon Labeling)
(Visschers and Siegrist 2015; Filimonau et al. 2017; Osman and Thornton 2019)

Appealing Menu Language
(Vennard, Park, and Attwood 2018; Turnwald, Boles, and Crum 2017)

Choice Architecture
(Bacon and Krpan 2018)

Increase Plant-Rich Menu Options
(Garnett et al. 2019; Attwood et al. 2020)

Reduce the Amount of Meat in a Dish
(Reinders et al. 2020)

Default Plant-Rich Menu w/ Option to Add Meat
(Campbell-Arvai, Arvai, and Kalof 2014; Hansen, Schilling, and Malthesen 2019)

Eliminate Meat from the Menu
(Anderson and Gross 2021)

One "Plant-Rich Day" per Week
(Atwood et al. 2020)

Figure 6.
A range of behavior change strategies to reduce meat consumption in restaurant contexts.

"eco-friendly" label have been rated as tastier compared to identical products with a "conventional" label (Sörqvist et al. 2015). Foods considered environmentally friendly, such as seasonal fruits and vegetables, have also been considered tastier (Siegrist, Visschers, and Hartmann 2015).

The application of these descriptions in restaurant contexts has primarily been focused on menus, and there are some promising findings. Krpan and Houstma (2020) found that online study participants were twice as likely to select a vegetarian dish when the vegetarian menu category was described using pro-environmental framing ("Environmentally Friendly Main Courses for a Happy Planet") over an identical menu with a vegetarian menu category simply framed as "Vegetarian Main Courses" (Krpan and Houtsma 2020). Another online experimental study conducted by the World Resources Institute explored the effectiveness of messages with various themes, such as taste, healthfulness, and connecting with nature. The message with the theme of "Small Changes, Big Impact," which contextualizes the emissions savings of swapping a meat dish for a vegetarian dish in terms of energy use to charge one's phone, led participants to select a vegetarian dish twice as often compared to the control group (Blondin et al. 2022).

Unfortunately, studies evaluating descriptive environmental messaging in real restaurant contexts are limited and show very modest shifts in purchasing behavior, if at all. A series of field experiments in three Palo Alto-area restaurants testing dynamic norm messaging found that communicating how customers choose meatless dishes more often on the menu increased vegetarian orders by a mere 1-2.5% (Sparkman et al. 2020). Examples of this intervention can be found in Figure 7. Another field experiment testing dynamic norms in a UK restaurant chain found no impact on plant-based ordering. However, some of this failure was attributed to poor adherence to the intervention by participating restaurants and inconsistent placement of the intervention messaging (Çoker et al. 2022).
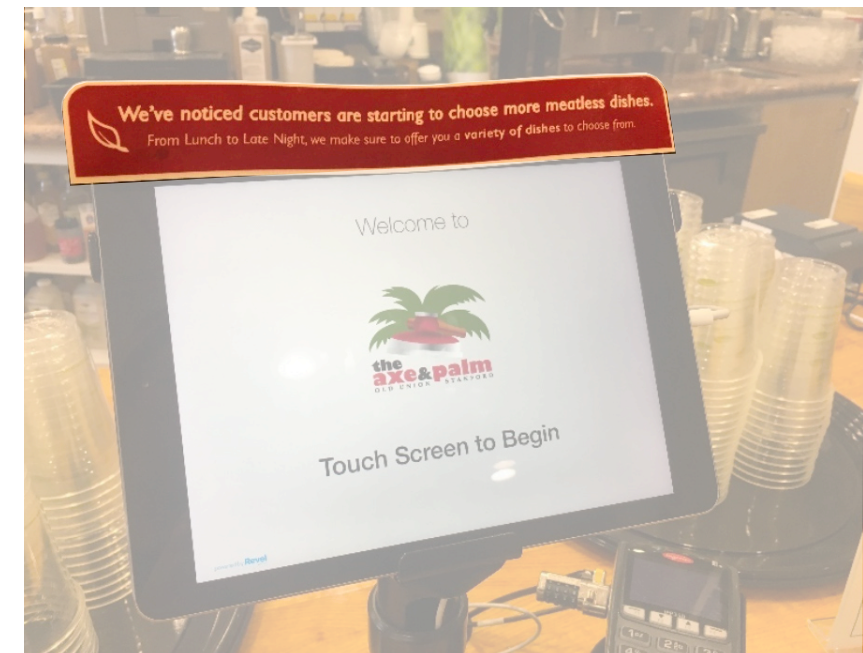
Figure 7. *Dynamic norm interventions by Sparkman et al. (2020).*

Both of these studies reveal that implementing these interventions requires more than simply placing an informational message in a restaurant environment, then hoping that a customer will read it and adjust their behavior. Both Sparkman et al. (2020) and Çoker et al. (2022) reflect on the importance of the location and visibility of messaging. In Çoker et al. (2022), messages were placed on digital screens in a queue of rotating images, which may not have been a suitable location for customers to be taking in such information while making a food choice. The researchers also experienced tension with the partner restaurant chain, which wanted to feature their most profitable, non-plant-rich items on the digital screens, highlighting the need for future researchers to build closer relationships with restaurant managers and staff. Additionally, Sparkman et al. (2020) note the importance of crafting and pre-testing messaging that relates well to customers in a given restaurant context. For example, community-oriented messaging in a university restaurant resonated with returning customers and the university community, leading to increased vegetarian selections, while similar messages backfired among wealthier customers in a more expensive restaurant (Sparkman et al. 2020). Participants also interpreted these messages to be exclusively for vegetarians, and therefore meat-eaters did not believe the message was intended for them and were unlikely to change their food choices (Sparkman et al. 2020). Though these studies were not tremendously successful, these early attempts demonstrate the need for close collaboration with restaurant managers, staff, and customers to implement intervention strategies tailored to a given restaurant context, a skillset that design practitioners can readily contribute.

Symbolic Environmental Messaging (Carbon Labeling)

Symbolic environmental messaging refers to the use of symbols or "ecolabels" to communicate sustainability criteria of a product or service (Blondin et al. 2022). More specifically, carbon labels commu-

nicate a product or service's total life cycle emissions (Upham, Dendler, and Bleda 2011). These labels can take one of three forms: (1) numeric, which indicates the amount of carbon dioxide equivalents emitted per functional unit (i.e., the amount of GHG emissions per serving or per 100g of protein); (2) a single "climate-friendly" label that is displayed on dishes that are below a defined emissions threshold; (3) a "traffic light" system, whereby colors indicate ranges of emissions (green indicating low emissions, red indicating higher emissions) (Visschers and Siegrist 2015). Examples of these labels are in Figure 8. These labels aid consumers in comparing items within a product category or dishes within a menu to make lower-emissions choices.

Carbon labeling has been studied in both grocery and non-restaurant foodservice contexts with some success. An Australian field experiment in a grocery store resulted in modest changes in purchasing patterns when traffic-light style labeling was implemented. Black-labeled (high emissions) sales decreased by 6%, and green-labeled sales increased 4%. When green-labeled items were also the cheapest, 20% of the black-labeled sales switched to green-labeled sales (Vanclay et al. 2011). Another field experiment testing a single "climate-friendly" label paired with informational posters in a Swiss university cafeteria increased sales of lower-emission meals while maintaining customer satisfaction (Visschers and Siegrist 2015). An online choice task experiment simulating a cafeteria environment found that traffic-light labeling demonstrating environmental and health impacts (Figure 8) resulted in more low-carbon and low-calorie meal selections, especially when paired with information to contextualize the labeling (Osman and Thornton 2019).

Studies assessing the effectiveness of carbon labels in restaurant settings have mixed results. A UK field experiment testing numerical carbon labels alongside nutritional information in a casual restaurant menu found that half of the interviewed customers incorporated the carbon values into their decision-making (Filimonau et al. 2017). The

Numeric

(Just Salad 2022)

Single Label
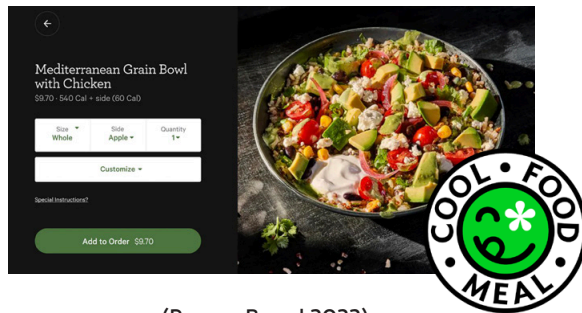
(Panera Bread 2022)

Traffic Light

(Osman and Thornton 2019)

Figure 8. *Carbon label examples.*
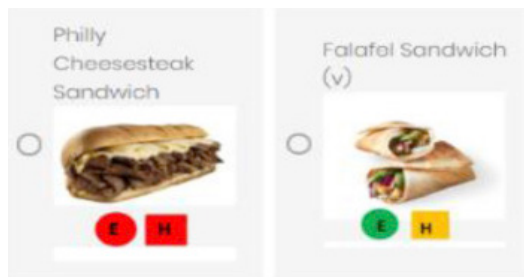
other half of the customers either overlooked the labels or misunderstood them. Those who discounted carbon values cited the desire to "unwind" or "have a good time" when dining out, similar to the challenges discussed earlier in this contextual review (Filimonau et al. 2017). Additionally, through their eye-tracking task experiment, Babakhani, Lee, and Dolnicar (2020) found that carbon labels on their test menu were not successful at attracting attention.

Despite the lack of conclusive evidence on their efficacy, carbon labels have already been implemented in a few larger restaurant chains, such as Just Salad and Panera, as shown in Figure 8. Though these companies have not released any findings on whether it has impacted customer selections, it signals that the industry is interested in educating its customers on the impacts of food choices.

Appealing Menu Language

Enhancing the names of dishes and their descriptions on restaurant menus has become an emerging strategy to increase the selection of plant-based foods. An online study by the World Resources Institute tested the appeal of vegetarian dishes with names that varied in their level of indulgent-sounding language (i.e., "Vegetable Lasagna" vs. "Triple Cheese and Slow-Roasted Vegetable Lasagna") and found that the more descriptive names were deemed more appealing by meat-eating consumers. It was also found that including "meat-free" language in a dish's description was ineffective for selling to meat-eaters while emphasizing the food's flavor, taste, or enjoyment appeared to be more successful (Vennard, Park, and Attwood 2018). Similarly, a study in a Stanford University dining hall found that 25% and 41% more diners selected vegetable dishes when the dish was labeled using more indulgent language compared to the "basic" and "healthy-restrictive" descriptions, respectively (Turnwald, Boles, and Crum 2017). From this research, the World Resource Institute's Better Buying Lab recommends

that US and UK restaurants and retailers avoid using the terms "meat-free," "vegan," "vegetarian," and healthy restrictive terms like "low fat" to drive sales of plant-based food and to use language that highlights the dishes' provenance, flavor profile, color, and texture (Wise and Vennard 2019).

This strategy has been tested in a few real-world restaurant settings with significant results. In 2018, Panera tested various names for their "Low Fat Vegetarian Black Bean Soup" and found that renaming it to "Cuban Black Bean Soup," highlighting the heritage of the dish, increased its sales by 13% during the trial (Vennard 2019). A similar study by Sainsbury's, the UK supermarket chain, swapped "Vegetarian Sausages and Mash" with the more origin- and taste-forward title, "Cumberland Spiced Veggie Sausage and Mash," which resulted in a 76% increase in sales during the trial period (Wise and Vennard 2019). These results show promise for this intervention strategy, especially because it requires little time or monetary investment on the part of a restaurant. However, there have not been any published studies implementing enhanced language for plant-rich items across an entire restaurant menu at the time of writing.

Using Design to Translate Behavior Change Intervention Research

In Designerly Ways of Knowing, Nigel Cross (2006) asserts that designers integrate knowledge and skills from the natural world (i.e., the sciences) and the human experience (i.e., the humanities) to address real-world, ill-defined problems. In this wicked problem of reducing meat consumption, designers are uniquely positioned to synthesize scientific knowledge, such as industrial ecology and behavioral psychology, with humanist knowledge, such as art and anthropology, to translate behavior change intervention strategies into real-world contexts. This integration of knowledge occurs throughout the entire

design process, from high-level problem framing to the iterative development of intervention materials, which will be explained below.

In framing the design problem, designers analyze each actor's actual, situated behavior in a system and "discover the underlying causes of the human behavior and redesign the system so as to eliminate them" (Norman and Stappers 2015). In practice, understanding how restaurant stakeholders shape and reinforce food choices can involve conducting observations, engaging stakeholders in interviews and in facilitated generative research activities, and developing case studies, among many other design research methods. The discipline employs synthesis tools such as journey mapping, affinity diagramming, and storyboarding to draw out opportunities from the collected data to intervene in the system.

This groundwork informs the intentional development of designed artifacts to support the identified intervention opportunities. Whether a new menu design or a physical display of food options in a restaurant, these artifacts provide "a form of knowledge about how to satisfy certain requirements, about how to perform certain tasks" (Cross 2006, 9)—in other words, customers know how to use these objects to make a food choice. Designers are skilled at defining and embedding new requirements or knowledge into these concrete objects to be interpreted in new ways (Cross 2006)—for example, a carbon labeling system affords new knowledge to aid customers' food selections. Designers are equipped to contribute to these challenges because the practice has the necessary form-giving skills and principles, such as composition and color theory, to create and manipulate objects expertly.

Design's absence from this wicked problem becomes apparent when examining the carbon label intervention materials produced by Filimonau et al. (2017) and Babakhani, Lee, and Dolnicar (2020), as shown in Figure 9. Both of these materials were not designed by trained visual communication design practitioners, and therefore they did not have
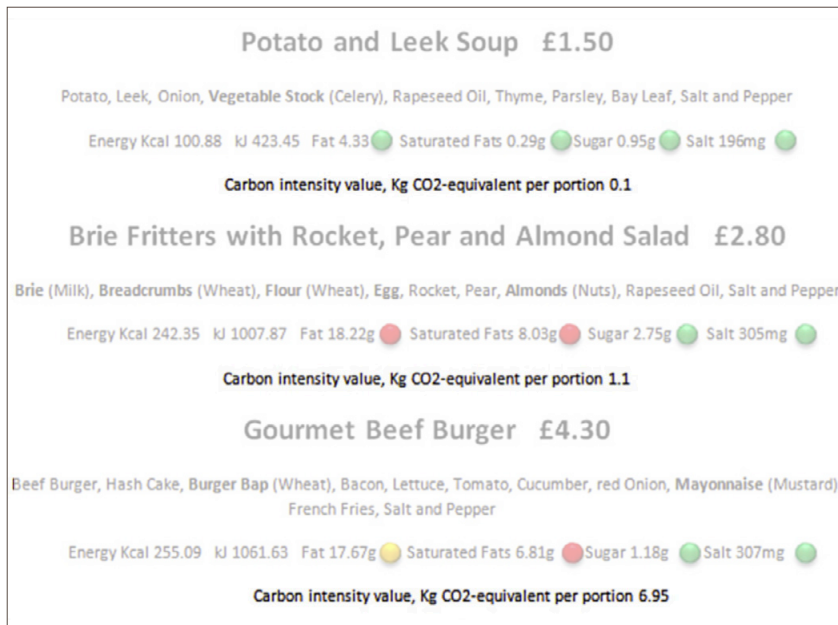
(Filimonau et al. 2017)
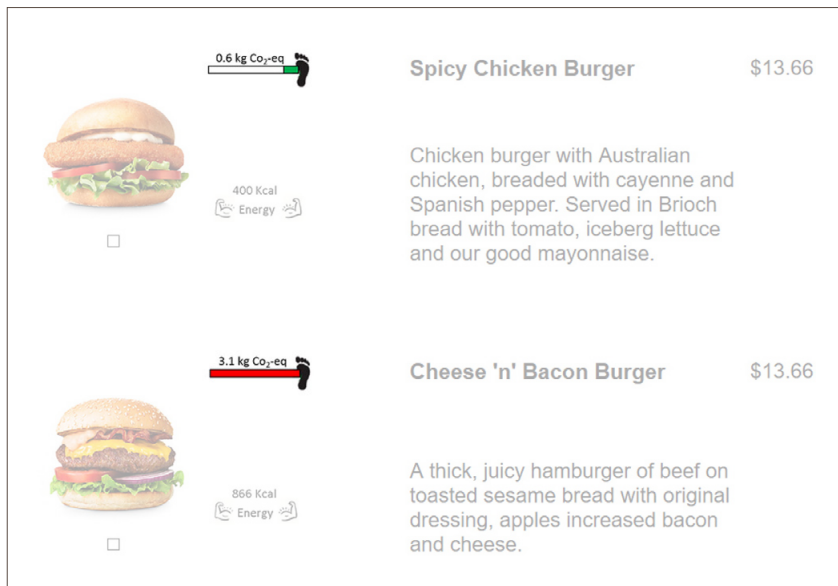
(Babakhani, Lee, and Dolnicar 2020)

Figure 9. *Carbon labels tested by Filimonau et al. (2017) and Babakhani, Lee, and Dolnicar (2020).*

the skills to develop a menu design with proper visual hierarchy nor with the quality that would be reflective of what most customers would interact with in most restaurants. Both materials minimize the presence of their carbon labels which increases the likelihood of customers overlooking it, with Filimonau et al.'s (2017) labels listed at the bottom of each dish in small type, and Babakhani, Lee, and Dolnicar's (2020) labels located away from the main content of the dish entry and also set in small type and with a small scale. Additionally, both rely on numerical carbon labels, which were misunderstood by many of Filimonau et al.'s (2017) participants, and while Babakhani, Lee, and Dolnicar (2020) included a foot icon to represent a carbon footprint, which may draw some unappealing associations when presented alongside food options (Lesli Hoey, pers. comm.). With carbon labeling, in particular, designers are desperately needed to bridge the technical information describing the various GHG impacts of food options with customers' everyday food choices.

Throughout the research and design process, Norman and Stappers (2015) also stress that designers must play an active role in implementation by working with stakeholders to minimize any social, cultural, economic, or political disruptions through repeated prototyping and refining. The implementation issues and overall efficacy in Çoker et al.'s (2022) study may have improved had there been a more collaborative relationship with restaurant managers and staff, additional prototyping to refine the visibility of their interventions, and facilitated conversations to explore the cycle of inertia occurring in the restaurant's desire to showcase their best-selling, high-carbon dishes and downplay the intervention.

With these design orientations in mind, the remainder of this contextual review will focus on the design approaches I integrated into this project.

Design for Sustainable Behaviors

Design for Sustainable Behaviors (DfSB) is a relatively new subfield of the design discipline that "is concerned with the application of behavioral theory to understand users and behavior-changing strategies to design products, services, and systems that encourage more sustainable use" (Lilley and Wilson 2017). Before the emergence of DfSB, much of the work to reduce the environmental impacts of products and services has been focused on other points of the lifecycle, such as manufacturing, energy efficiency, and disposal. Understanding the use phase and user behaviors of a given product will help sustainable designs reach their full potential (Lilley et al. 2018). The field integrates research from various disciplines, including social psychology, persuasive technology, sustainable consumption, industrial ecology, stake-

holder analysis, and interaction design (Boks 2012). This subfield has primarily focused on durable goods that are resource-intensive in the use phase, such as showers and refrigerators, but it has the potential to be applied to other contexts, such as reducing meat consumption.

The Range of DfSB Interventions

Lilley and Wilson (2017) present an "axis of influence" that organizes behavioral interventions into a spectrum to convey the level of decision-making power between the user and the designed product, system, or environment, as shown in Figure 10a. This illustration incorporates categorizations and classifications of DfSB intervention strategies from muliple scholars in the discipline. The types of interventions are defined into three broad categories: *Informing*, *Persuading*, and *Determining*.

USER	Information	Feedback	Enabling		Encouraging	Guiding		Steering	Forcing	Automatic	PRODUCT
		(Informing)				(Persuading)			(Determining)		
	Eco-information	Eco-choice	Eco-feedback		Eco-spur	Eco-steer		Eco-technology		Clever design	
		(Conversation)			(Conversation with force)				(Force)		
		Eco-feedback (Guides change)				Behavior steering (Maintains change)			Persuasive technology (Ensures change)		

POWER IN DECISION MAKING

Figure 10a. Axis of Influence *by Lilley and Wilson (2017). Each row represents classifications of DfSB intervention strategies by various scholars in the discipline. Categories from the top row are sourced from Zachrisson and Boks (2012); middle row from Bhamra, Lilley, and Tang (2011); and bottom row from Lilley (2009).*

I will describe how a user's decision-making power varies among the categories using showering as an example. At the far left of the spectrum, *Informing* strategies offer users the most power. These interventions simply provide information to users about the resources used in a given behavior without forcing a particular action. A shower timer can inform users about the amount of water consumed and can prompt users to end their shower earlier than they otherwise would, but users still maintain the power to ignore the information and continue showering without consequence. On the far right, design interventions incorporating *Determining* strategies exert the most power in decision making. These coerce change with the use of context-aware technologies. A shower system employing a *Determining* strategy might track a user's average water temperature settings and gradually decrease the water temperature to slowly acclimate the user to shower with colder water and reduce energy consumption without their knowledge. In the center of the axis, design interventions using *Persuading* strategies attempt to encourage a particular behavior without removing options from users. A shower system incorporating a *Persuading* strategy

might have settings that utilize a low flow rate by default to reduce water consumption but allow users to temporarily increase the water pressure for specific showering tasks, such as rinsing shampoo.

For the purposes of this project, I adapted this axis of influence in three ways, as illustrated in Figure 10b. First, my adaptation focuses on the classifications proposed by Zachrisson and Boks (2012), as these are considered to be the most commonly referenced categorizations in DfSB research (Lilley and Wilson 2017). Coincidentally, they also parallel Wellesley, Happer, and Froggatt's (2015) *Informing*, *Nudging*, and *Forcing* categorizations of meat consumption reduction interventions (see Figure 6). Second, I chose to frame the level of decision making as "agency" rather than "power." *Agency* more precisely describes the capacity of the user to "actively and independently choose and to affect change," whereas *power* refers to "influence or exercise control over other people and achieve their goals despite possible opposition or resistance" (Bell 2016). Finally, rather than employing the term "product" at the far right of the axis, I chose "intervention" to encompass non-product interventions, such as services and policies.

USER
AGENCY

Informing
*infomation,
feedback, enabling*

Persuading
encouraging, guiding

Determining
*steering, forcing,
automatic*

INTERVENTION
AGENCY

AGENCY IN DECISION MAKING
(*freedom, choice, control*)
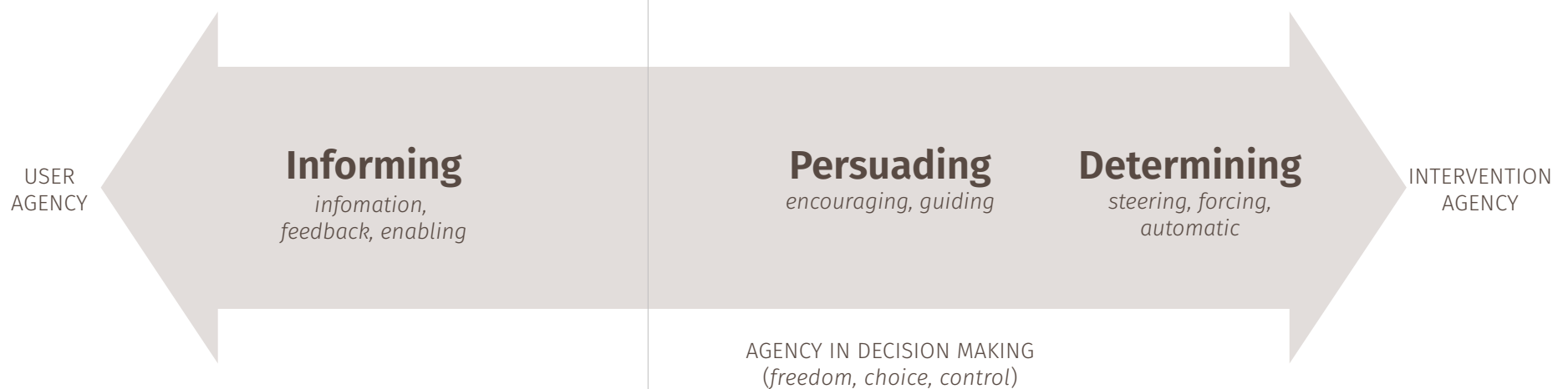
Figure 10b. *The* Axis of Influence, *adapted from Lilley and Wilson (2017)
with classifications sourced from Zachrisson and Boks (2012).*

The following subsections describe these intervention categories further and draw connections with interventions to reduce meat consumption in restaurants.

Informing Strategies

Similar to the information-based meat consumption reduction strategies described earlier in the contextual review, *Informing* or *Feedback* strategies offer users the most control in decision-making. Products or services guide change by using tangible visual, tactile, or aural indicators to educate users about their resource consumption rather than coerce users to change their behavior (Lilley 2009, Lilley and Wilson 2017). These indicators, such as displaying real-time energy savings when adjusting a thermostat or viewing changes in electricity usage on a well-designed energy bill, aim to help users build cognitive connections between a behavior and the consequences of that behavior, resulting in user reflection and, ideally, a shift to less resource-intensive behavior (Wilson, Bhamra, and Lilley 2015). To encourage consumption of lower-carbon menu items, *Informing* strategies can take the shape of descriptive environmental messaging, which uses simple language to convey the environmental impacts of food choices to customers, or symbolic environmental messaging that communicates food impacts numerically or by use of symbols (Blondin 2022).

As Wilson, Bhamra, and Lilley (2015) indicate, informational strategies have some challenges. Feedback relies upon metrics, such as energy units, cost, or environmental impact, but no single unit satisfies every user and context. For example, in energy-saving feedback systems, displaying kilowatt-hours (kWh) may be difficult for some users to connect with their everyday actions, whereas displaying cost may be a stressful indicator, and communicating carbon emissions may only be comprehended by few (Wilson, Bhamra, and Lilley 2015). This challenge

is important to consider for employing a carbon labeling strategy for El Harissa's dishes, as it is a metric-heavy intervention that all customers may not fully grasp.

Additionally, feedback in its purest form is a means of displaying consumption and does not necessarily motivate a user. Hazas, Brush, and Scott (2012) criticize DfSB's feedback interventions and underlying assumptions that people have the time, competency, and technology to act upon feedback. People cannot always juggle sustainability with other commitments and values, such as family needs or taste preferences. Additionally, informational strategies such as traffic-light labels may be met with reactance, a psychological state where individuals feel that their personal freedoms are threatened and take action to restore that freedom by engaging in the "restricted" behavior (Kunz et al. 2020)—such as selecting a beef dish from El Harissa's menu. Designing carbon labels not to induce guilt or reactance among El Harissa's customers presented a consideration for this project, see *Methodology, Phase 4*.

Persuading Strategies

In *Persuading* strategies, designers use affordances and constraints to steer behavior without forcing user action (Lilley and Wilson 2017). Affordances, conceived by perceptual psychologist J.J Gibson ([1977] 2014), refer to the relationship and actionable properties between an environment and an actor, whether an animal or a human. In a design sense, Norman (2002) describes affordances as an object's perceived and actual properties, whose fundamental properties determine how one could use it. Affordances provide cues to the user, and when employed well, the user quickly knows what to do. While affordances indicate what is possible, constraints limit the number of actions that can take place. Constraints can be physical, semantic, cultural, or logical (Norman 2002, 84–88).

Scripts are related to affordances and provide a basis for persuading strategies. Jelsma and Knot (2002) describe scripts as "a product layout guiding the behavior of the user, in a more or less forceful way, to comply with values and intentions inscribed into the product by the designer." If a product or service's script aligns with the user's logic, the product will be used in the intended fashion, ideally to reduce resource consumption (Jelsma and Knot 2002). For example, a styrofoam cup communicates to the user that it is disposable, while a fine china teacup communicates careful long-term use (Lilley 2007). The concepts of affordances, constraints, and scripts relate to the nudging strategies described earlier in the contextual review in that they guide change without removing options. For example, the values and intentions inscribed in a menu with an increased proportion of plant-rich dishes communicate to customers that plant-rich dishes are the norm and have been shown to increase the likelihood of those dishes being selected (Garnett et al. 2019; Attwood et al. 2020). At the same time, that menu acknowledges that customers still may want to select a meat dish and does not eliminate those choices. Within El Harissa, other menu design elements, such as dish descriptions, could afford or *script* the selection of a plant-rich dish by emphasizing characteristics that align with a customer's ordering logic or values. As will be described in the *Results* section, El Harissa customers frequently use dish descriptions to make selections and are drawn to dishes with interesting ingredients or labor-intensive preparation methods. This finding led us to leverage the menu's dish descriptions and emphasize characteristics of each plant-rich dish that would appeal to customers, such as flavor profiles, textures, and culinary origins. This intervention strategy contributed to customers' decision-making processes by aligning with their taste- and preparation-forward values while nudging customers to select lower-carbon choices.

The prime challenge of persuading strategies is anticipating and designing for unexpected user behavior. Users may overcome designed constraints and not perform the desired behavior, which Jelsma and

Knot (2002) call "anti-programs." A driver who evades a car's built-in seatbelt warning system by plugging the seat belt in and sitting atop it would be an example of "anti-programming" (Lilley 2007). To overcome this, Jelsma and Knot (2002) suggest that designers collaborate with users to anticipate potential anti-programs of future users.

Determining Strategies

Determining strategies ensure change, primarily through intelligent context-aware technologies without the knowledge or consent of the user (Lilley 2009). These persuasive technologies gather data from Bluetooth, GPS, motion sensors, and other sources and deliver it to the user or another product to influence behavior (Lilley 2007). Examples include windows that open automatically on a hot day to regulate temperature and the Nest Protect smoke detector, which tests itself automatically (Lilley and Wilson 2017).

Lilley (2009) outlines the challenges of determining strategies. Persuasive technologies remove decision-making from the user, separating cause and effect. Users may be less likely to learn from and adapt their behavior without that feedback. Users may be less likely to accept these strategies due to a perceived lack of choice. Data privacy is another concern, especially if a third party monitors a user's data. Finally, some users may be encouraged to "game the system" and increase rather than reduce negative impacts or find ways to disable features.

Lilley and Wilson's (2017) interpretation of determining strategies translates the least well to Wellesley, Happer, and Froggatt's (2015) framework of meat consumption reduction strategies. It is unlikely that Bluetooth, GPS, and other data inputs would be required to implement price increases on meat dishes. However, the removal or reduction of the user's decision-making is relevant. Eliminating meat dishes from the menu, whether on a temporary or permanent basis, may make customers dissatisfied, especially if there is little explanation for the

change. As a result, customers could "game the system" by dining elsewhere and negatively impacting El Harissa's bottom line. For this reason, Yusef and I decided that the potential negative economic impact of removing meat options from El Harissa's menu was too high, and we therefore did not take this approach.

The DfSB Process

Lilley and Wilson (2017) have established a sequence of five stages that encompass the DfSB process: (1) understand the user's actions in context, (2) specify the target behavior, (3) select intervention strategy(ies), (4) produce intervention solutions, and (5) evaluate solutions against the target behavior. Ethical considerations encompass all of these phases (Lilley and Wilson 2017). A diagram of this process is displayed in Figure 11, and each phase will be briefly described.

Understanding Users in Context

Understanding the context of use is essential for identifying internal and external factors that influence user action. It allows the designer to investigate and potentially leverage affordances, constraints, social norms, rules, and laws to challenge and affect habit formation. DfSB integrates and assimilates models from behavioral psychology at this stage to understand drivers of behavior and uncover multiple points for intervention. Various research methods can be employed to investigate behavior, such as interviews, focus groups, surveys, probes, and shadowing (Lilley and Wilson 2017).

Specifying the Target Behavior

Understanding the user behavior in context then informs the selection of the behavior(s) the designer intends to change. The literature is thin on how this selection process takes place. Lilley and Wilson (2017) pose that a target behavior could be selected based upon the severity of its environmental and social impact. Tang and Bhamra (2012) studied

Figure 11. *The DfSB Design Process, adapted from Lilley and Wilson (2017).*

the various behaviors of refrigerator use and focused on reducing the frequency and duration of opening the refrigerator in their design interventions, which account for 1-3% of a refrigerator's electricity use. However, other behaviors, such as inserting warm foods and setting operating and room temperatures, have higher energy impacts.

Selecting Intervention Strategies

Selecting an intervention strategy must be taken with care. A determining strategy that is too forceful may be resisted and rejected by users, while on the other hand, an informational strategy may be too passive to motivate the user to consider and act upon the information. Users may not link their behavior to resource consumption if the intervention does not employ any information or feedback, potentially leading to rebound effects and unsustainable consequences (Lilley and Wilson 2017).

Lilley et al. (2018) recommend selecting interventions based on three variables. The first is the user's level of compliance, which is a function of their previous responses to a behavioral intervention. This suggests that if the user has ignored an informational or behavior-steering strategy, then selecting a strategy that places more control on the part of the product or service would be deemed appropriate. The second variable is the gravity of the consequences, which is calculated by evaluating the predicted outcomes against socio-economic concerns. The context and level of habit influencing the behavior comprise the third variable. For habitual behaviors that require little reflection, such as a customer ordering their go-to dish, it is recommended to implement "forcing and determining" strategies to "disrupt and intervene in routinized thought processes and direct behavior." An informing strategy may be sufficient for less automatic behaviors and require more consideration, such as dining at El Harissa for the first time and assessing all of the menu options (Lilley et al. 2018).

Produce Intervention Solutions

With the strategies defined, interventions are designed using an iterative development process with pilot testing (Lilley and Wilson 2017). Lilley and Wilson recommend that designers avoid introducing bias when developing a design intervention and not instigate a premature change with users in preceding phases before the actual implementation (Lilley and Wilson 2017).

The intervention will also need to consider the evaluation phase in its design. The length of the testing period will determine features of the intervention design, such as materials and data collection plan. The designer will need to ensure that the intervention will function for the full duration of the testing period and address any potential ethical, health, and safety issues that may arise from implementation (Lilley and Wilson 2017).

Evaluation

The DfSB literature frames the evaluation of an intervention in three core components: (1) the usability and function of the designed intervention; (2) the ecological, social, and economic impact of the intervention; and (3) the resulting change in user behavior due to the intervention (Lilley and Wilson 2017). The evaluation of an intervention involves three questions:

1. *Does the design intervention function for the specified context?*
   This question determines if the design intervention is usable for the target audience and operates as intended.

2. *Is the change in the user's behavior sustainable?*
   This question measures the change in sustainability metrics, defined in terms of economic, environmental, and social pillars.

3. *Has the user's behavior changed as a consequence of the design intervention?*
   This question assesses the intervention's ability to change the habitual behavior of the user by focusing on changes in the user's context, intentions, and cognitive automaticity (which informs habit).

Capturing a baseline of existing behavior and comparing it with the post-intervention behavior is critical to evaluation. Information to evaluate an intervention can be collected via qualitative means, such as user observation, and quantitative means, such as recording energy consumption or time (Lilley et al. 2018).

Ethical Considerations

Lilley and Wilson (2013) propose how ethical considerations can be integrated into the DfSB process. In the *Understanding User Context* phase, designers should perform an ethical review of the methods and modes of data collection involving human subjects. When the designer is *Specifying the Target Behavior*, stakeholders are recommended to be

involved in this process to help determine the ethical impact of designing for specific behavior. As the designer produces the intervention solution, the designer should pause and reflect on a proposed intervention's potential intended and unintended outcomes and impact on the target user and other stakeholders (Lilley and Wilson 2013). Again, this reflection can take place with stakeholders to uncover ethical implications and create a more democratic design process. In the *Evaluation* phase, Lilley and Wilson (2013) put forward a list of questions to assess the ethical dimensions throughout a DfSB project. These questions address the intent, motivations, and responsibility of the designer; whether the methods employed in the research and development of the design interventions were ethical; whether users had sufficient control of the intervention; and whether the intended or unintended outcomes of the intervention were ethical.

Rationale for Integrating DfSB

At the time of writing, DfSB has not yet been applied to reducing meat consumption, and more generally, Clune and Lockton (2017) acknowledge that the design discipline has not fully explored sustainable food choices. Yet, food and restaurant environments have multiple touchpoints that can be designed to encourage the selection of plant-rich dishes, including the composition of each dish, the presentation of dishes, how options are conveyed on a menu, customer and staff interactions, and the design of the physical environment (Attwood et al. 2020). Lilley and Wilson's (2017) *Axis of influence*, which parallels the range of current meat consumption reduction strategies, combined with DfSB's model of inquiry, moving from understanding the context of use to implementing interventions, lend themselves well to translating behavior change research into real-world contexts.

However, there are a few elements of DfSB that I have attempted to challenge in this project. Frequently cited DfSB projects (Wilson 2013; Tang 2010; Hanratty 2015) involve users only in the early phase of "understanding users in context" and in the final stage of "evaluation." Not involving users or other stakeholders beyond these phases positions the designer as an "expert" who imposes interventions on test subjects. The involvement of stakeholders is primarily discussed when considering the ethical implications of the project (Lilley et al. 2018; Wilson 2013), not in the design, production, and implementation of interventions. Boks and Daae (2017) acknowledge the need for DfSB to expand its focus to other actors beyond the user. Co-Design approaches may supplement the DfSB process, which will be described next.

Co-Design

Sanders and Stappers (2008) define Co-Design as "the creativity of designers and people not trained in design working together in the design development process." In this design paradigm, users or stakeholders are viewed as experts of their own experience: the researcher becomes a facilitator to encourage users and stakeholders, and the professional designer supports generative design thinking with new tools and methods, as well as provides expert knowledge that stakeholders do not have (Sanders and Stappers 2008). Kleinsmann and Valkenburg (2008) define Co-Design beyond user participation to incorporate knowledge exchange and integration: "Co-Design is the process in which actors from different disciplines share their knowledge about both the design process and the design content...to be able to integrate and explore their knowledge and to achieve the larger common objective: the new product to be designed."

Co-Design activities engage non-designers in three main forms: *telling*, *making*, and *enacting* (Sanders and Stappers 2012 p66). *Telling* techniques help participants express opinions, past experiences, and needs through interviews, storyboarding, diaries, and other methods (Sanders, Brandt, and Binder 2010). *Making* techniques help people recall memories, make interpretations and connections, see and explain feelings, and imagine future experiences (Sanders and Stappers 2012 p70). One example is generative toolkits, which are curated sets of 2D and 3D components that non-designers use in facilitated sessions to create artifacts about the topic of interest (Sanders and Stappers 2014). *Enacting* techniques refer to observing people, their activities, the objects they use, and the settings where they conduct these activities (Sanders and Stappers 2012 p66).

A few sustainability studies employ Co-Design methods to inform behavior change interventions. Bowie et al. (2020) engaged coffee consumers in a workshop series to gain feedback on twelve types of interventions to implement within their university and generate ideas for an ideal intervention strategy. After the workshop, the researchers converted the Co-Design intervention ideas into testable intervention prototypes to be implemented in a follow-up study (Bowie et al. 2020). In a study generating ideas for reducing single-occupancy commutes on a university campus, it was found that the group of participants who engaged in Co-Design activities, such as story creation and ideation sessions, generated significantly more innovative ideas compared to the study's email-based consultative cohort. The Co-Design cohort was also able to think more broadly about the context of university travel and produced potential solutions that were separate from their own travel mode (Mitchell et al. 2016). These projects' success indicates promise for applying Co-Design approaches to designing interventions to reduce meat consumption.

As with DfSB, Co-Design has been underutilized in addressing the reduction of meat consumption in any context. However, the above Co-Design definitions and their techniques resonate with the aims of this project. Restaurants provide a dynamic environment in which to Co-Design, as customers, staff, and owners all have unique expertise to inform the design of behavior change interventions. All of these techniques can be used to probe participants, gain a better understanding of participants' everyday experiences, and generate design concepts (Sanders, Brandt, and Binder 2010), which could provide tremendous value to DfSB and the wicked problem itself. The methodology section will describe how Co-Design supplemented the DfSB process in this project.

Recruitment

1. Understand Users in Context

Generative

Qualitative Analysis

2. Specify Target Behavior

Observations (AEIOU)

Customer Exit Survey

Ad-hoc Interviews

5. Evaluate Solutions

Debriefing Interview

ETHICAL CONSIDERATIONS

Analyze Sales and GHGs

Qualitative Analysis

3. Select

4.

METHODOLOGY

Rationale + Overview

This project aimed to design behavior change interventions to increase the consumption of low-carbon, plant-rich dishes and decrease the consumption of high-carbon meat dishes at El Harissa. In order to translate the meat reduction intervention literature into a real-world restaurant context, an integration of Design for Sustainable Behaviors

(DfSB) and Co-Design was adopted. DfSB was chosen because it aims to address resource-intensive user behaviors and follows a process that can explore many types of everyday behaviors. Co-Design was chosen to supplement this process to incorporate the perspectives and ideas of El Harissa customers, staff, and managers. Figure 12 (next page) provides an overview of the research phases, the methods employed, and the stakeholders actively participating in each method.

I desired to have all owners, staff, and a significant number of customers contribute to all phases of the project—the initial inquiry, the generation of strategy ideas, and the design of pilot menu materials—because the transition toward more sustainable living is a "wide-reaching social learning process" where various forms of knowledge and capabilities are valued (Manzini 2007). Yusef Houamed, El Harissa's manager, was a significant contributor throughout the entire process. However, coordination limitations with El Harissa's owners and staff, paired with the project's time constraints, impacted full participation. Therefore, active participation of customers occurred in *Understanding Users in Context* and *Evaluation* phases, and modest staff participation occurred in providing feedback on the intervention materials in Phases 4 and 5.

Phase 0: Restaurant Partner Recruitment

The first step in this project, after framing the thesis proposal, was to recruit an Ann Arbor area restaurant or foodservice business. In September 2021, I approached four restaurants that participated in Green Fare, Ann Arbor's inaugural food event featuring locally sourced and plant-based dishes, which occurred three months earlier. As these restaurants have an established relationship with the City's Office of Sustainability and Innovations, I hypothesized that they might be more

willing to explore strategies to encourage plant-based choices. During their less busy hours, I patronized each of these restaurants, introduced the project to either waitstaff or a manager, provided informational flyers (located in Appendix A), and followed up via email after visiting.

I received two responses from these restaurants. A manager from a local brewpub had some interest but highlighted customer preference and staffing shortages resulting from the COVID-19 pandemic as reasons why it was not an appropriate time for their business to engage in this project. El Harissa was the other interested establishment. After meeting with Yusef, we determined that our interests aligned.

Phase 1: Understanding Users in Context

As described in the contextual review, *Understanding Users in Context* aims to identify factors that influence resource-intensive actions and potential areas for intervention (Lilley and Wilson 2017). Within El Harissa, the objective of this phase was to establish the current state of plant-rich dining in the restaurant and the internal and external factors that influence customers' selection of plant-based and meat-based dishes. For this project, "users" are defined as any stakeholder interacting with or within El Harissa's business and are represented in the stakeholder diagram in Figure 13, where solid lines with double arrows indicate a direct relationship among users. These user-stakeholders either make food choices (i.e., the customers) or influence food choices (i.e., owners, staff, suppliers) and would be directly or indirectly impacted by a design intervention and therefore warrant study. The central rectangle encompasses El Harissa's owners, managers, and staff, who can influence food choices by changing the menu or offering customers suggestions. The figures in purple represent the business entities
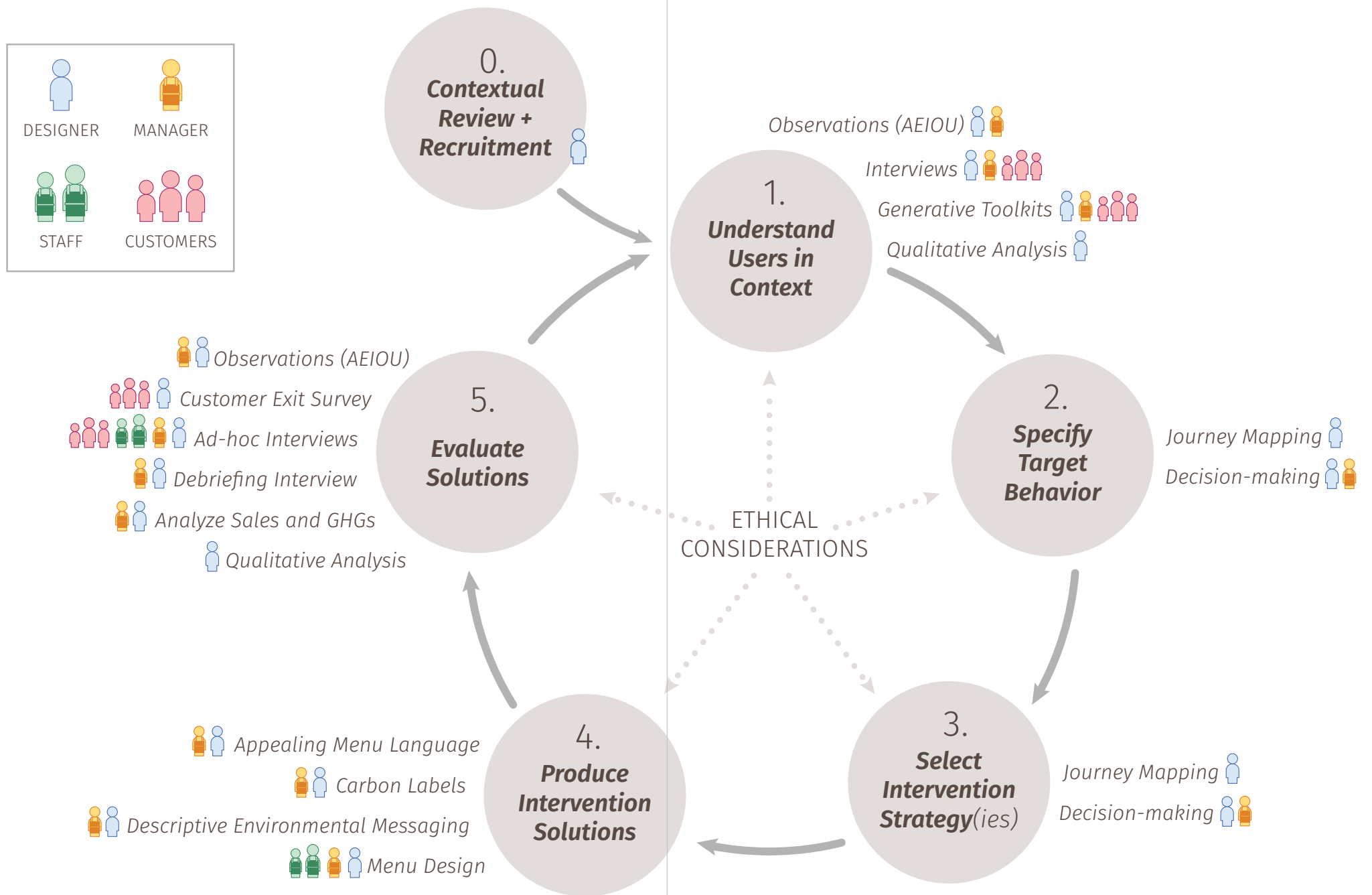
Figure 12. *Integration of DfSB and Co-Design with stakeholder participation in each phase.*

DESIGNER
MANAGER
STAFF
CUSTOMERS

0.
Contextual Review + Recruitment

1.
Understand Users in Context

Observations (AEIOU)
Interviews
Generative Toolkits
Qualitative Analysis

2.
Specify Target Behavior

Journey Mapping
Decision-making

3.
Select Intervention Strategy(ies)

Journey Mapping
Decision-making

4.
Produce Intervention Solutions

Appealing Menu Language
Carbon Labels
Descriptive Environmental Messaging
Menu Design

5.
Evaluate Solutions

Observations (AEIOU)
Customer Exit Survey
Ad-hoc Interviews
Debriefing Interview
Analyze Sales and GHGs
Qualitative Analysis

ETHICAL CONSIDERATIONS

Figure 13. *El Harissa stakeholder diagram.*

that El Harissa engages with, such as vendors and suppliers, who may indirectly influence food choices due to ingredient availability and price fluctuations.

The figures in red represent various types of El Harissa customers. Customers who visit El Harissa's brick-and-mortar location, on the far left of the diagram, are the restaurant's primary customer base in terms of sales volume and comprise of young professionals, new families, retirees, professors, residents of nearby neighborhoods, and students from nearby public schools (Yusef Houamed, pers. comm.). Second from the left, catering customers range from brick-and-mortar customers order-

ing dinner parties for a small group to university departments hosting large events. University of Michigan Dining customers, second from the right, are comprised of students and other members of the university community who visit the university's union dining locations which feature local restaurants. Yusef and his staff visit Maizie's in the Michigan League and Fireside Cafe in Pierpont Commons each week during lunch hours with a scaled-back menu. On the far right, retail customers are patrons of independent grocery stores and other food businesses that purchase a selection of El Harissa's dishes wholesale. All of these customers are connected with dotted lines, as there is some overlap among these segments, such as a brick-and-mortar customer ordering catering or a retail customer visiting the brick-and-mortar location after purchasing one of their salads.

The users highlighted in green in Figure 13—brick-and-mortar customers, university dining customers, Yusef, and El Harissa's staff—were the focus of this phase's investigation. These stakeholders were selected because Yusef was able to provide the most access to these users, and at this particular point in the process, we deemed that the brick-and-mortar and university dining venues would be the most appropriate areas to possibly implement a design intervention. The high sales volume of the brick-and-mortar location could potentially lead to a large reduction in emissions, and El Harissa's smaller menu served at the university dining venues could lend itself to manipulation for a series of more minor interventions. On the other hand, during this study period, catering orders were low due to the COVID-19 pandemic, making it difficult to investigate and develop an intervention. Additionally, the dishes that El Harissa sells to area food businesses already do not contain meat to avoid additional regulations from the U.S. Department of Agriculture (Yusef Houamed, pers. comm.). Since this retail context already includes a Forcing or Determining strategy to reduce meat consumption, implementing an additional intervention would not provide much value.

El Harissa's customers are the primary stakeholders whose food choices Yusef and I attempted to shift with a design intervention. Therefore, it is necessary to understand their experiences with El Harissa, their perspectives on plant-rich diets, their level of knowledge and concern for the food system's impact on the environment, and integrate these findings into the intervention design. In this phase, Yusef and I aimed to establish:

1. **Customers decision-making process and considerations when ordering a meal at El Harissa.**
   Rationale: Understand how the design intervention might leverage factors that influence customer choice, such as values (i.e., taste, environment), how dishes are presented, and staff recommendations.

2. **Customers' understanding of the environmental impact of animal products and how this information affects what they select in restaurant settings.**
   Rationale: Determine if customers would be open to an informational intervention strategy, determine how environmental considerations are weighed against other factors when ordering.

3. **Customer experience with and perspectives on plant-rich diets.**
   Rationale: Understand customer preferences and reasons for adopting or not adopting plant-rich diets, what types of ingredients are appealing or unappealing in order to inform new dishes.

4. **The barriers and enablers for selecting plant-rich dishes in restaurant settings.**
   Rationale: Eliminate or minimize the barriers to selecting plant-rich dishes, leverage enablers.

5. **Attitudes towards sustainability initiatives that El Harissa has implemented previously.**
   Rationale: Understand if customers are open to additional sustainability initiatives

The restaurant, encompassing its owners, managers, and staff, creates and shapes the environment where food choices are made. Therefore, it is also important to understand their experience, perspectives, and constraints as a business and consider them when designing the intervention. With El Harissa, I aimed to establish:

1. **How the restaurant owners, managers and/or staff develop the menu and what factors they take into account.**
   Rationale: Inform whether developing new dishes would be a viable intervention strategy.

2. **Their understanding of the environmental impact of animal products and how knowing this affects what they offer.**
   Rationale: Capture a baseline of how environmental considerations influence their menu.

3. **Their perspective on plant-rich diets and dishes.**
   Rationale: Determine how they position their plant-rich dishes (i.e. only for vegans), if they would be open to developing more plant-rich dishes.

4. **The barriers and enablers in creating and promoting plant-rich dishes in their restaurant.**
   Rationale: Eliminate or minimize the barriers to selecting plant-rich dishes, leverage enablers.

5. **What changes they might be willing to make to encourage plant-rich choices.**
   Rationale: Determine their level of comfort with and bandwidth for various intervention strategies.

Observations

Observation sessions at El Harissa's brick-and-mortar location and the local restaurant stations inside the two University of Michigan unions situated me in the context where the intervention would be deployed. It provided a firsthand account of the phenomenon of interest, in this case, customers ordering a meal and interacting with staff, without relying solely on secondhand accounts from interviews, where routine behaviors may go unnoticed by owners, staff, and customers (Merriam and Tisdell 2015). I employed the Activities, Environments, Interactions, Objects, and Users (AEIOU) framework, as described by (Martin and Hanington 2012), to structure my observation sessions at both locations. Table 1 illustrates sample questions that informed these observations, organized by the AEIOU framework.

I conducted three observation sessions at El Harissa's brick-and-mortar location in October 2021. These were "fly-on-the-wall" observations (Martin and Hanington 2012) where I did not actively engage with customers or staff unless they initiated interaction with me. Each session started with checking in with a staff member and confirming their consent to have me observe. I then situated myself in their small seating area to handwrite notes. The questions formulated from the AEIOU framework guided my note-taking, highlighting how customers interacted with the deli case, the staff, and the market area. Numbers were assigned to each customer as they entered the restaurant to track the actions of multiple customers in the space and maintain a count of transactions. Occasionally, Yusef would stop by as I observed to elaborate on routine and non-routine interactions with customers. These brief conversations could be described as ad-hoc "anchored interviews," where questions I had were anchored to a specific instance, such as a significant customer interaction (Merriam and Tisdell 2015).

Activities	• *How do customers approach the deli counter and order?* • *What happens during a pick-up order?* • *Are customers decisive about what they order, or do they linger?*
Environments	• *Do the time of day and weather affect what customers order?* • *How do customers and staff interact with the deli and market zones of the business?*
Interactions	• *How do the staff and customers interact with each other? How does it change for newer customers compared to regulars?*
Objects	• *How are the dishes displayed in the deli case?*
Users	• *Who are the customers? What age, gender, and other characteristics?* • *Do customers come in alone or in groups?* • *How do newer customers compare to regulars?*

Table 1. *AEIOU framework applied to Phase 1 observation sessions.*

I conducted an observation session at each of the University of Michigan union locations where El Harissa and other local restaurants are featured: Maizie's in the Michigan League and Fireside Cafe in Pierpont Commons. My research role shifted to participant-as-observer (Allen 2017), where I served customers alongside Yusef and his staff while taking mental notes of customer interactions with the menu, food display, and staff. I assisted Yusef during these short shifts by preparing to-go boxes and tracking orders. The ebb and flow of the shift allowed for additional ad-hoc anchored interviews. Observations were documented after each session so as not to disrupt the flow of the work shift.

Observation Analysis

Activities, Environments, Interactions, Objects, and Users (AEIOU) provided a framework to code the observations from El Harissa's brick-and-mortar location and the two weekly stations on the U-M campus into broad categories. I let these categories remain high-level to provide just enough context and framing to develop the semi-structured interviews and identify behavioral intervention opportunities. Tables 5a and 5b in the Results section illustrate a summary of the most relevant observations and implications for the subsequent steps of this project.

Semi-Structured Interviews

Conducting observations in both settings provided context and reference points for formulating customer, staff, and owner semi-structured interview protocols (Merriam and Tisdell 2015). Rubin and Rubin (2012) refer to qualitative interviews as "conversations in which a researcher gently guides a conversational partner in an extended discussion," and help the researcher understand and reconstruct events in which they did not participate (Rubin and Rubin 2012). Semi-structured interviews use predetermined but open-ended questions (Given 2008). This flexible format allowed me to dive into participants' subjective behaviors, feelings, and interpretations, particularly El Harissa's customers, whom I could not observe directly (Merriam and Tisdell 2015). The research protocol for these interviews was submitted to the University of Michigan IRB and was exempt from full review. The protocol, interview discussion guides, recruitment materials, and consent forms are located in the appendix.

I conducted two, one-hour interview sessions with Yusef in person at El Harissa in November 2021. In addition to the objectives described earlier in this phase, these sessions explored the day-to-day operations at El Harissa, El Harissa's customer base from a manager's perspective, how he approaches interactions with various customers, and oppor-

tunities for creating and promoting new plant-rich dishes. Interviewing the owners would have provided additional perspective, but they were not available for interviews, and I did not want to impose.

I completed sixteen, one-hour, one-on-one interviews with El Harissa customers over Zoom video conferencing in November and December 2021. An availability sampling strategy (Daniel 2012) was used to recruit participants. I provided Yusef and El Harissa staff with informational cards advertising the study to share with customers, including a link and corresponding QR code to a Qualtrics survey form that provided additional information about the study. If interested, the prospective participant would sign up for an interview. These interviews covered the objectives described earlier in this phase. I also engaged participants in a facilitated activity using MURAL, an online collaboration tool, detailed in the next subsection. Upon completion, each participant received a $25 El Harissa gift certificate as a token of appreciation, funded by myself.

I had planned to conduct three to five thirty-minute one-on-one interviews with El Harissa staff to gain insight into their day-to-day experience, how they interact with customers to guide choices, and how they understand the links between food and sustainability. I attempted to recruit El Harissa staff using a flyer and Qualtrics sign-up form similar to the customer recruitment and offered a $25 Visa gift card as an incentive. However, this research method proved infeasible due to schedule conflicts and staff shortages resulting from COVID-19.

Co-Designing the Customer Interview Research

The research protocol for the customer interviews was developed in collaboration with Yusef, particularly questions about supporting a business that values sustainability and providing inspiration for the *El Harissa Test Kitchen*, described below. With the sustainability questions, Yusef wanted to learn how his customers perceive the restaurant's participation in the City of Ann Arbor's Returnable Container

Pilot, a city-wide effort to reduce single-use plastic takeout containers, and if those sentiments would hold if they took on other sustainability efforts, such as an intervention to increase plant-rich dining. The *El Harissa Test Kitchen* grew out of Yusef's desire to understand if certain ingredients would draw customers to a particular dish. What started as a simple checklist of ingredients that participants would select turned into the following generative activity.

El Harissa MURAL Board and Generative Activities

After asking a customer participant a couple of warm-up questions, I directed them to a MURAL board to augment the interviews, as shown in Figures 14a-c. Visual tools can facilitate probing, help participants reconstruct experiences, and "elicit thoughts that are difficult to verbalize (Glegg 2019)." The first section of the board, Figure 14a, contained El Harissa's menu and images of their deli case. With this visual aid, I prompted participants to describe a recent visit, including what was ordered, how they interacted with staff, and what factors were considered.

Once acquainted with MURAL, I transitioned participants to the generative activities on the board: the *Test Kitchen* and *Describe Your Dish*. As described in the contextual review, generative toolkits are tailored sets of 2D and 3D components that provide non-designers a means to create expressive artifacts about the topic at hand without requiring pre-existing design skills (Sanders and Stappers 2014). These *making* activities, such as toolkits, combined with saying activities, such as interviewing, can corroborate each other (Sanders and Stappers 2012), yielding rich results that can be analyzed to reveal patterns (Sanders and Stappers 2014). Generative toolkits and other participatory approaches have been present in some DfSB research (Lockton 2019; Lockton et al. 2011) and were deemed useful for drawing out customers' perspectives and contributing ideas, both of which would help ensure the selection of appropriate intervention strategies. The following generative activities supported El Harissa customers to envision new ideas for plant-rich dishes, communicate their qualities, and reveal their experience and values around plant-rich diets and reducing meat consumption both in a dining context and at home.
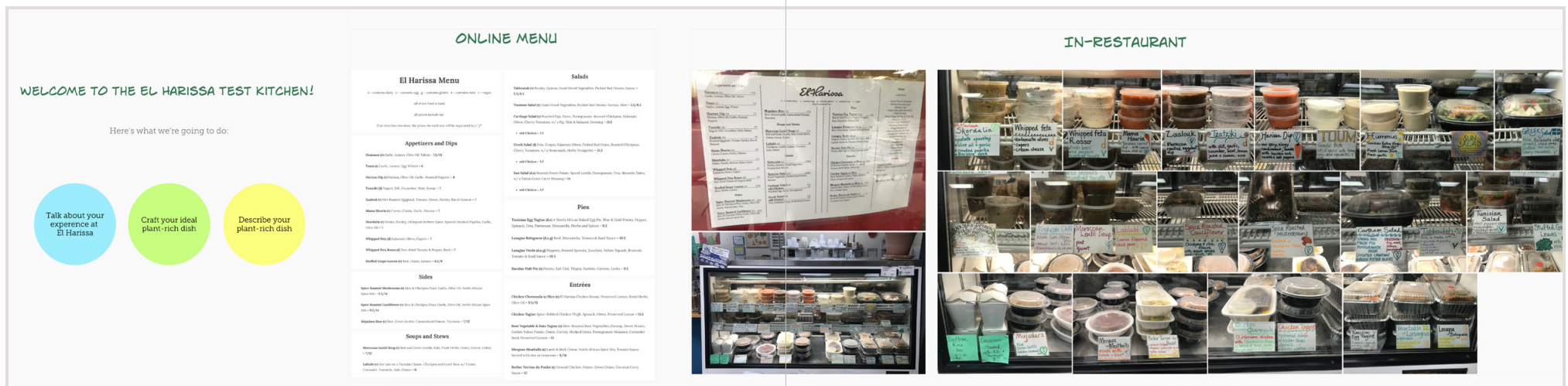
Figure 14a. *Sections 1-2 of the El Harissa MURAL Board.*

Figure 14b. *El Harissa Test Kitchen.*

In the *Test Kitchen*, Figure 14b, I asked participants to envision their ideal plant-rich dish which would be hypothetically sold at El Harissa. Participants composed their dish by dragging and dropping images of ingredients—used by El Harissa and in North African cuisine more broadly, organized by vegetables, fruits, dairy and eggs, plant-based proteins, legumes, grains, nuts and seeds, and spices. The primary intent of this exercise was to understand if particular ingredients, preparations, or other attributes within a dish resonated with customers. These insights would then inform new plant-rich dishes at El Harissa and potentially increase the ratio of plant-rich dishes to meat dishes within their menu, an effective strategy to increase plant-rich dish selection (Garnett et al. 2019; Parkin and Attwood 2022). The secondary intent of this thinking-through-making exercise was to prime participants for discussion about plant-rich diets.

HOW WOULD YOU DESCRIBE YOUR DISH IN A MENU?

spicy hearty lentil pot pie

FLAVORS

acidic	
citrusy	briny
firey	
salty	sour
tart	bitter
herbal	nutty
sweet	smoky
cooling	buttery
creamy	
	zesty
jammy	

earthy
vegetarian
baked
spicy
roasted
savory
flaky
hearty   rich
tangy
local   fresh

TEXTURES

airy	delicate
crumbly	crunchy
chewy	crusty
doughy	smooth
melty	sticky
fluffy	crispy
gooey	silky
moist	
soft	succulent
creamy	tender
velvety	
pillowy	

PREPARATION METHODS

toasted	browned	pickled	pan-fried
fermented	chilled	grated	caramelized
blanched	grilled	broiled	braised	smoked
marinated	candied	infused	seared	breaded
sauteed	blended	blackened	shredded	fried
whipped	charred	poached	glazed	

OTHER ATTRIBUTES

	authentic	sustainable	
		plant-based	
aromatic	vibrant	fragrant	
seasoned	decadent	heavy	
healthy	lean	vegan	
	light		

Figure 14c. *Describe Your Dish activity.*

After discussing the participant's ideal plant-rich dish in the *Test Kitchen*, I copied it into the *Describe Your Dish* activity in Figure 14c. Inspired by the research on appealing menu language (Vennard, Park, and Attwood 2018; Wise and Vennard 2019; Turnwald, Boles, and Crum 2017), participants were instructed to select words that positively describe the taste, texture, preparation, and other attributes of the dish they created. This activity intended to identify descriptors that attract or disengage customers, uncover the meanings customers associate with those words, and inform how El Harissa could enhance the descriptions for plant-forward menu items.

Interview and Generative Activity Analysis

Each customer interview and interview session with Yusef were transcribed using Rev speech-to-text services and analyzed using a combination of affinity diagramming, structural coding, open coding, and axial coding. Affinity diagramming offers a visual infrastructure for analysis, whereby relevant interview excerpts are recorded on sticky notes, interpreted for their significance, clustered with similar excerpts,

Figure 15. *Interview analysis.*

formed into larger groups, and give rise to themes and insights (Martin and Hanington 2012). Structural coding, which uses research and interview questions to frame broad categories (Saldaña 2021), provided organization to the data corpus. Open coding (Bryant and Charmaz 2007) allowed for the creation of additional codes to bring more detail to the categories created by structural codes. I then transitioned to axial coding, which "aims to link categories with subcategories and ask how they are related (Charmaz 2014)," to reorganize the data and draw out findings. I initially conducted this analysis in MURAL and transferred the work to a physical format for more flexibility, as shown in Figure 15. The most relevant findings from the interviews with Yusef and El Harissa's customers are represented in Tables 6a and 6b in the Results section.

The discussion that arose during the *Test Kitchen* and *Describe Your Dish* activities was analyzed using the same coding methods as the rest of the interview transcripts. The dish concepts, including the descriptors, were analyzed to find underlying patterns. The analysis process I used most closely resembles content analysis, a set of "research techniques for making systematic, credible, or valid and replicable inferences from texts and other forms of communication (Drisko and Maschi 2016)." For each dish, I referred back to the customer participant's transcript to summarize its "essence" since every concept detail was not elucidated in the toolkit (i.e., the order in which ingredients were prepared). A sample of these dish concepts and notes can be seen at the top of Figure 15. Then the dishes were compared in terms of how ingredients and descriptors were combined. A count of each ingredient and descriptor were taken to determine if certain ingredients or words were prevalent.

Phase 2: Specifying Target Behavior

Journey Mapping

The analysis of the observations, interviews, and generative activities led to specifying the target behavior. Lilley and Wilson (2017) propose to target behaviors that have the highest environmental or social impact. The nature of this project already determined that meat consumption in El Harissa would be addressed, which is more environmentally impactful than other food behaviors, such as packaging and food waste (Hoolohan et al. 2013). However, at the beginning of this phase, it was not yet clear where in the business Yusef and I would focus. Journey maps were employed as a synthesis method to forge connections between the interview and observation data with the behavior change interventions described in the contextual review (Kolko 2010;

2012). Journey maps are visual representations of a person's process of completing a task or goal. Information about the person's emotional state, perceptions, and other dimensions are layered upon the individual steps (Stickdorn and Schneider 2011; Kalbach 2016; Kolko 2012). Information gathered from observations and interview questions structured around customers' ordering processes and overall experience at El Harissa were aggregated into journey maps representing five different scenarios: (1) ordering in person as a first-time customer, (2) ordering over the phone, (3) planning a catered meal, and (4,5) visiting El Harissa's two stations at U-M. Each map outlined the main phases of ordering, and each phase included detailed specific customer or staff actions, customer emotions, customer pain points, customers' internal questions, areas to improve the customer experience, and opportunities to implement a design intervention. An example map depicting the journey of a first-time customer is shown in Figure 16.
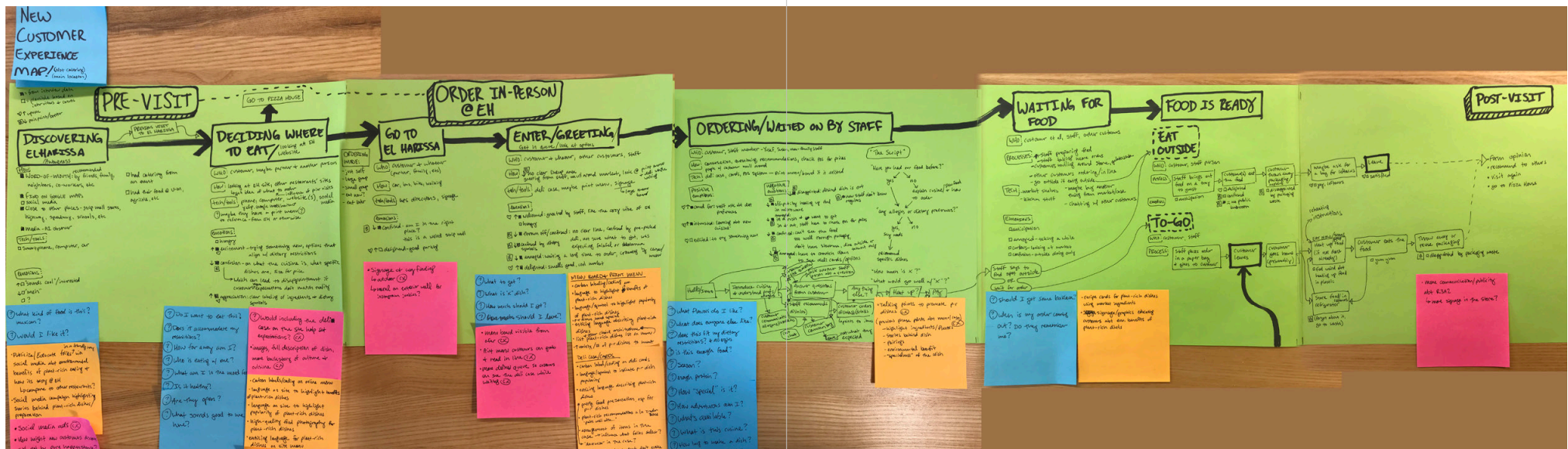
Figure 16. *Customer Journey Map of a first-time El Harissa customer. The green letter-size paper outlines individual steps, while the blue, orange, and pink sticky notes indicate customer questions, opportunities for design intervention, and improvements to the customer experience.*

Decision Making

The journey maps contextualized the barriers and enablers to reducing meat consumption and revealed multiple points for intervention across El Harissa's customer experiences. However, addressing all of them was not possible within the timeframe of this project. Yusef and I chose to contain the inquiry to in-person ordering at their brick-and-mortar location, as it is the restaurant's most common mode of ordering in terms of sales, leading to a potentially more significant reduction in greenhouse gas emissions. Moreover, if the design intervention were successful in that core use case, we determined that it could translate to other aspects of their business relatively easily.

Phase 3: Selecting Intervention Strategies

Journey Mapping, Round 2

With the use case determined, a revised customer journey map was created to encompass the moments between a customer entering El Harissa and consuming their order, as shown in Figure 17. The intervention strategies identified in the original journey map were organized by touchpoint, such as a menu or staff member, and placed roughly in the order in which a customer would interact with it. Each touchpoint delineated informing and nudging interventions. Forcing interventions, such as Meatless Monday, where no meat would be served on a given day (Meatless Monday n.d.), were not a direction that Yusef wanted to pursue due to potential economic risk, so those strategies were eliminated from consideration. Intervention opportunities in Figure 17 were evaluated using the following criteria:

Timeline: *Can we implement the intervention within the bounds of the academic calendar?*

Extent of Design Contribution: *Does the intervention leverage the skills of the design practitioner?*

El Harissa's Willingness and Bandwidth: *Is El Harissa comfortable with the potential risks of implementing a particular intervention? Does El Harissa have the time and resources to take on a particular intervention?*

Alignment with Observation and Interview Findings: *Does the intervention address the barriers and enablers uncovered in Phase 1?*

Evidence from the Literature: *How effective are the interventions as demonstrated in the scholarly literature? What implementation challenges could we overcome in this study?*

Decision Making

After a series of conversations discussing how each strategy matched up against the criteria, Yusef and I strategically selected a combination of *Descriptive Environmental Messaging*, *Symbolic Environmental Messaging*, and *Appealing Menu Language* interventions to develop and test. Customer interview participants were open to learning more about the impact of their food choices as long as it is presented in a friendly manner. As Lilley and Wilson (2017) describe, informing interventions, such as *Descriptive Environmental Messaging* and *Symbolic Environmental Messaging*, help link environmental impacts with a particular behavior. However, informing strategies may be too

Journey Map: New Customer, Order In-Person at El Harissa

PRE-VISIT	IN-STORE EXPERIENCE				POST-VISIT
Go to El Harissa	**Enter/Greeting**	**Ordering**	**Waiting**	**Eating**	**Form Opinion**
Decide Where to Eat					**Recommend**
Discover El Harissa					**Visit Again**

CUSTOMER ACTIONS

- Greeting from staff
- Get in "line"
- Look at print menu (if available) and deli case while waiting to order
- Peruse the market while waiting to order

- Learn about the cuisine from staff member
- Share any dietary restrictions or allergies
- Consider options in the deli case
- Ask staff questions

- Receive recommendations from staff
- Discuss options with others if eating with others
- Select dish(es)
- Indicate dine-out or take-out order and pay

- Peruse the market while waiting for the order, perhaps buy something additional
- Chat with other customers
- Find a table outside if dining on-premises

- Dining on-premises: Staff member brings order to the table, customer eats, then discards packaging
- Take-out: Staff member puts order in to-go bag, customer goes home or elsewhere to eat, store leftover items

POST-VISIT: OUT OF SCOPE

TOUCHPOINTS

- word-of-mouth
- El Harissa website
- Social Media accounts
- Google Maps profile
- Traditional Media
- Yelp profile
- El Harissa's physical location + signage

PRE-VISIT: OUT OF SCOPE

CUSTOMER CONSIDERATIONS WHEN ORDERING

? What am I in the mood for?
? I wonder what this dish is?
? What sounds good to me?
? What does everyone else want?

? What's recommended?
? Does this fit with my dietary restrictions?
? Is this enough protein?

? Could I make this at home?
? How adventurous do I want to be?
? What's available?

? Should I get something in addition to what I just ordered?

POTENTIAL STRATEGIES BY TOUCHPOINT:

Print menu / Menu board

Information Strategies:
- Indicate low-impact food choices with a carbon labeling scheme
- Highlight the environmental benefits of choosing plant-rich dishes with friendly messaging
- Indicate the growing popularity of plant-rich dishes with dynamic norm messaging or labeling

Behavior Steering Strategies:
- Incorporate enticing language for plant-rich dishes
- List plant-rich items first on the menu (already sort of doing)
- Incorporate a "staff favorites" section showcasing a plant-rich dish
- Vegan/vegetarian labeling that avoids stigma? (reference the literature)

Deli Case, Cards, + Food Presentation

Information Strategies:
- Indicate low-impact food choices with a carbon labeling scheme
- Indicate the growing popularity of plant-rich dishes with dynamic norm messaging or labeling

Behavior Steering Strategies:
- Enhanced food presentation for plant-rich dishes
- Incorporate a "staff favorites" section that showcases a plant-rich dish
- Manipulate arrangement of items in the case to bias toward plant-rich choices
- Incorporate enticing language for plant-rich dishes
- Pairing recommendations for plant-rich items
- Vegan/vegetarian labeling that avoids stigma? (reference the literature)

El Harissa Staff

Information Strategies:
- Train staff to have friendly talking points about the environmental benefits of El Hariss's plant-rich options

Behavior Steering Strategies:
- Train staff to recommend plant-rich dishes with talking points highlighting flavors, ingredients, preparation, aand stories behind the dish
- Train staff to recommend plant-rich pairings

Interior Space

Information Strategies:
- Highlight the environmental benefits of choosing plant-rich dishes with friendly messaging

Behavior Steering Strategies:
- Tell stories behind the various plant-rich dishes at El Harissa via signage and graphics

The Food

Behavior Steering Strategies:
- Offer small to-go samples to expose customers to new plant-rich dishes
- Increase variety and relative number of plant-rich dishes to meat dishes (particularly for entrees)
  » Develop plant-rich dishes that have a "wow" quality, whether they incorporate unique or colorful ingredients, appear time- or labor-intensive, or feel inventive
  » Develop plant-rich dishes that aren't at odds with common dietary restrictions or allergies
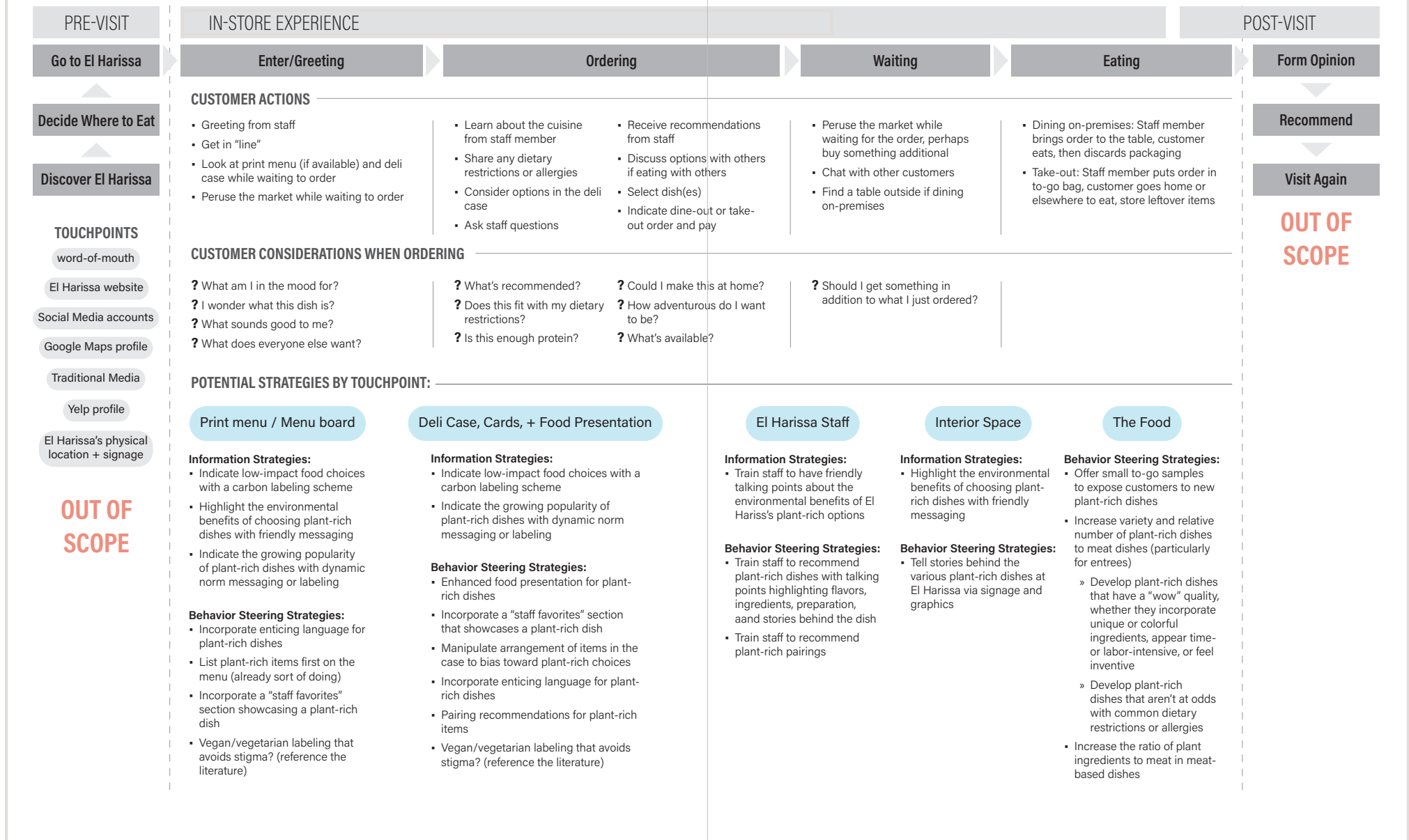- Increase the ratio of plant ingredients to meat in meat-based dishes

Figure 17. *Revised Customer Journey Map with intervention strategies from Figure 6.*

passive, especially for returning customers whose ordering may be more habitual, so we opted for a persuading or nudging strategy (i.e., *Appealing Menu Language*) as a supplement. Forcing strategies may have had more influence on returning customers, yet we did not want to reduce customers' freedom of choice, cause a potential backlash, and negatively impact El Harissa's economic sustainability.

In particular, *Symbolic Environmental Messaging*, or carbon labeling, was selected over other strategies because El Harissa did not already have the necessary design skills to develop a label or the know-how to calculate the carbon footprint of their dishes and would therefore benefit from the guidance of a design practitioner. Additionally, while carbon labels have shown promise in the literature (Vanclay et al. 2011; Visschers and Siegrist 2015; Osman and Thornton 2019), they could be greatly improved by designers who are trained to integrate highly technical information into forms and concepts that customers can readily interpret and act upon. *Descriptive Environmental Messaging* was then selected to pair with the carbon labeling scheme to help decode the labels and place them into context. Finally, the interviews and observations revealed that customers frequently reference the descriptions under each menu item to learn about the ingredients and filter out options, so we determined that *Appealing Menu Language* should be leveraged in those descriptions to nudge consumers to plant-rich options using taste-forward language.

Once the above intervention strategies were selected, we determined that they would be integrated into three different touchpoints: a menu board, deli display cards, and a supporting informational flyer. Prior to this study, El Harissa did not have a menu board in their space, and Yusef and I determined that implementing this asset would leverage customers' queuing time to become acquainted with the carbon labels and review the taste-forward dish descriptions. We opted to integrate the *Symbolic Environmental Messaging* and *Appealing Menu Language* interventions into the deli cards because it is a regular touchpoint

that returning customers use to make food choices as well as to be consistent with the menu board. To help provide customers with additional context about the carbon labeling, we determined that an informational flyer would be useful for customers to reference while they order or wait for their order to be prepared.

Phase 4: Produce Intervention Solutions

Specifying the target behavior–ordering in-person at El Harissa–and selecting the behavior change intervention strategies–Descriptive Environmental Messaging, Symbolic Environmental Messaging, and Appealing Menu Language–led to designing the intervention materials. The interventions developed concurrently with the menu board, deli cards, and informational flyer that would incorporate them.

Menu Materials

El Harissa desired a flexible menu board system whereby staff can remove dishes as they sell out during the day, add new items, and accommodate their eventual transition back to dine-in service. We explored various materials that would enable flexibility and determined that a magnetic board would be the best fit. However, we determined that it would be prudent to pilot the menu board using less expensive material and have the implementation findings inform a finalized design produced on more permanent materials. The design of this pilot menu board represents how it might look with the final materials, with the dark grey background representing the magnetic board and the dish category headers and dish entries representing tiles. The board, shown in Figures 18a and 18b, was printed on coroplast and installed above the deli case. The deli cards were designed once the dish entries for the menu board were finalized and are essentially scaled-down versions of them, as shown in Figure 18c.

DIPS

Hummus 7.5 / 13
The smoothest in Ann Arbor!
A buttery blend of chickpeas, tahini, and
olive oil with hints of lemon and garlic.

Tzatziki 7
A refreshing cucumber and yogurt sauce with
dill, mint, and sumac. Pair with any of our
dishes to add cool and crisp notes.
contains dairy

Skordalia 7
Smooth and garlicky potatoes whipped
with Ethiopian Berbere spices and smoked
paprika. Great with bread or as a flavorful
mashed potato side.

Whipped Feta 7
Our briny and airy feta spread dotted with
Kalamata olives and capers. Perfect with
fresh vegetables or toasted pita.
contains dairy

Mama Houria 7
A vibrant, Tunisian-spiced carrot spread with
spices, garlic, lemon, EVOO, and harissa. Called
Ummak Houria in Arabic, which translates to
"Your Mother the Fairy."

Toum 6
A bold, creamy garlic spread that you'll want
to put on just about anything.
contains egg

Harissa Dip 6
A zesty and piquant condiment. Tunisian harissa
mixed with EVOO, spices, and sweet roasted
red pepper. Add to any of our dishes for a
flavorful and spicy kick.

Zaalouk 7
Fire-roasted eggplant pureed with sauteed
tomatoes and onion. Seasoned with parsley
and ras el hanout–our top-shelf spice blend.

Whipped Feta Rosso 7
Tangy and bright feta spread with sun-dried
tomatoes, roasted peppers, and fresh basil.
Perfectly distills the flavors of the Mediterranean.
contains dairy

Ann Arborites are making changes to eat more sustainably, and so are we!

high   moderate   low

Join us on our journey and try our green dishes,
which have a low carbon footprint and
are kinder to the planet.

SPECIALS

APPETIZERS

Spice Roasted Mushrooms 9.5 / 14
Plump Silver Dollar mushrooms coated
and baked in rice and chickpea flour, olive
oil, and our North African spice blend.
Served with Harissa Dip.

Spice Roasted Cauliflower 9.5 / 14
Crispy cauliflower florets coated and baked
in rice and chickpea flour and our North
African spice blend. Served with Harissa Dip.

Stuffed Grape Leaves 4.5 / 8
Bite-sized bundles of seasoned rice and onion,
lovingly wrapped in lemony grape leaves.
Pairs well with Tzatziki, Skordalia, or Toum.

SOUPS & STEWS

Moroccan Lentil Soup 7.5 / 13
Nurturing and filling. Slowly simmered red
and green lentils with fragrant spices, fresh
herbs, kale, and mirepoix vegetables.

Lablabi 11
A robust and bright chickpea stew with
lentils, kale, onions, and loads of warm spices.
Our spin on a Tunisian classic.

Maghrebi Chili 8 / 13
Ground beef seasoned with Harissa spices
and slowly cooked with chickpeas, lentils,
black beans, peppers, and loads of vegetables.

MAINS

Root Vegetable & Date Tagine 15
Savory-sweet slow-roasted carrot, parsnip,
sweet and golden potato, caramelized onion,
pomegranate molasses, Medjool dates, and tangy
preserved lemon. Served with rice or couscous.

Tunisian Egg Tajine 9.5
A frittata-like egg pie packed with blue and gold
potato, roasted peppers, spinach, feta, parmesan,
mozzarella, and seasoned with herbs and spices.
contains egg, dairy

Lasagne Bolognese 10.5
Stacked high with layers of perfectly spiced
beef, homemade tomato basil sauce,
parmesan, ricotta, and mozzarella.
contains egg, dairy, gluten

Lasagne Verde 10.5
Loaded with vegetables, all hand-chopped
and sauteed to perfection, layered with
homemade tomato basil sauce, parmesan,
ricotta, and mozzarella. *contains egg, dairy, gluten*

Bacalao Fish Pie 10
A Maritime Shepherd's Pie!
A base of salt cod, tilapia, sardine, carrots, and
leeks topped with spiced whipped potatoes.

Chicken Chermoula 9.5 / 16
Roasted chicken breast in an herby green
sauce with preserved lemon and olive oil.
Served with saffron rice.
contains egg

Chicken Tagine 15.5
Boneless chicken thigh rubbed in spices and
cooked tender with spinach, green olives,
preserved lemon, onion, and ginger.
Served with saffron rice or couscous.

Mujadara Rice 7.5 / 13
A Levantine staple of spiced green lentils and
rice. Ours is adorned with carefully caramelized
golden onions for a touch of savory-sweetness.

Merguez Meatballs 9 / 16
Inspired by the Maghrebi sausage, our spiced lamb
and beef meatballs are hand-rolled with onions
and herbs and coated with a thick tomato sauce.
Served with saffron rice or couscous. *contains egg*

Berber Terrine du Poulet 12
Ground chicken with potato, green onion,
and fenugreek baked into small loaves.
Served with a citrusy coconut curry sauce.
contains egg

SIDES

Saffron Rice 2

Golden Couscous 2

DESSERTS

Black Tea & Saffron Rice Pudding 5.5 / 9
A richly spiced oatmilk-based rice pudding,
filled with juicy raisins. Topped with pistachios,
toasted almonds, and delicate rose petals.
contains nuts

Check out our Gelato & Sorbetto!

SALADS

Tabboulah 6.5 / 12
A fresh and filling parsley-based salad
packed with hand-diced vegetables, quinoa,
and tossed in a lemony sumac dressing.
Our twist on the Middle Eastern salad.

Tunisian Salad 6.5 / 12
Hand-diced bell peppers, crisp cucumbers, and
fresh tomatoes tossed with zesty house-pickled
red onions and a minty harissa dressing.
An authentic Tunisian staple.

add chicken to below salads 4

Carthage Salad 14
Tangy, sweet, and savory. Mixed greens topped
with poached figs, pomegranate seeds, dates,
Kalamata olives, cherry tomatoes, and crunchy
chickpeas croutons. Fig, mint, & balsamic dressing.

Greek Salad 14
Mixed greens topped with crumbled feta,
tart grapes, Kalamata olives, pickled red onion,
cherry tomato, and crunchy chickpeas.
Herby vinaigrette dressing. *contains dairy*

Sun Salad 14.5
Mixed greens topped with anise and fennel
roasted sweet potato, spiced lentils, jammy
dates, feta, pomegranate, and toasted almonds.
Tahini green curry dressing. *contains dairy, nuts*

Figure 18a. *Final menu board design.*

Figure 18a. *Final menu board installed inside El Harissa.*

Figure 18c. *Deli card design.*

Writing Appealing Menu Language

This intervention was focused on the dish descriptions rather than the dish names as they already reference traditional North African cuisine (i.e., zaalouk) or generate some interest among customers (i.e., Sun Salad). Crafting enhanced descriptions involved reviewing each menu item's list of ingredients; identifying relevant flavor, texture, and preparation descriptors, some of which were derived from the *Describe Your Dish* activity; and drafting the description to create a positive image in the customers' mind. We explicitly focused on the anticipated taste and enjoyment of the dish over its healthfulness, as health-focused language is less effective in increasing a dish's selection (Turnwald, Boles, and Crum 2017). Where relevant, we aimed to highlight special qualities of a dish, whether unique ingredients, careful preparation, or information about the origins of the dish to increase customer interest. Customer interviews revealed that they are more interested in selecting a dish when it is something one would not be bothered to make at home or had ingredients that they could not easily find.

Composing the descriptions was an iterative process. I composed an initial draft for each dish, which provided a framework for Yusef to formulate additional versions. Our versions were combined and revised until the word count was concise enough to fit on the menu board and deli cards. A selection of the enhanced descriptions is in Table 2.

Carbon Labeling

Calculating the Footprints and Determining Thresholds

A "traffic light," three-tier carbon labeling system was chosen as our form of symbolic environmental messaging. We chose this system because it allows customers to compare dishes across a whole menu without relying on unfamiliar units (i.e., carbon dioxide equivalents, or kg CO_2eq) and provides customers with more nuanced carbon footprint information than a single "climate-friendly" label.

Dish Name	Original Description	Enhanced Description
Harissa Dip	Harissa, Olive Oil, Garlic, Roasted Peppers	A zesty and piquant condiment. Classic Tunisian harissa mixed with EVOO, spices, and sweet roasted red pepper. Add to any of our dishes for a flavorful and spicy kick.
Tabboulah	Parsley, Quinoa, Hand-Diced Vegetables, Pickled Red Onions, Sumac	A fresh and filling parsley-based salad packed with hand-diced vegetables, quinoa, and tossed in a lemony sumac dressing. Our twist on the Middle Eastern salad.
Root Vegetable & Date Tagine	Slow-Roasted Root Vegetables (Parsnip, Sweet Potato, Golden Yukon Potato, Onion, Carrot), Medjool Dates, Pomegranate Molasses, Coriander Seed, Preserved Lemon	Savory-sweet slow-roasted carrot, parsnip, sweet and golden potato, caramelized onion, pomegranate molasses, Medjool dates, and tangy preserved lemon. Served with rice or couscous.

Table 2. *A selection of menu descriptions incorporating more appealing language.*

We used a Life Cycle Assessment (LCA) approach to determine the carbon footprint of each dish. We linked the primary ingredients of each recipe to emissions data derived from dataFIELD (database of Food Impacts on the Environment for Linking to Diets), a comprehensive review of food LCA literature (Heller et al. 2018). Average cradle-to-farm gate emissions data (i.e., all of the emissions associated with farm production) were used for most ingredients, such as potatoes, while average cradle-to-processor gate (i.e., farm production emissions, plus emissions associated with processing ingredients) and average total life cycle emissions data were used for a small number of ingredients, such as olive oil and tap water. Emissions data for each ingredient were multiplied by the ingredient weight in a given recipe, then all ingredient emissions were added together for the total dish emissions and then adjusted for serving size so that dishes could be compared on a per-portion basis. See Figure 19 for an example calculation and Table 3 for the emissions data for each dish.

Thresholds for each tier (low, moderate, high) were established upon calculating emissions across El Harissa's menu. Dishes less than 0.36 kg CO_2eq were classified as "low carbon," dishes between 0.36 and 0.999 kg CO_2eq were classified as "moderate carbon," and dishes with 1.0 kg CO_2eq and above were classified as "high carbon." Table 3 delineates these categories by color. These thresholds were chosen because it roughly delineates the type of foods that fall into each category, with the "low carbon" category primarily including vegan dishes; the "moderate carbon" category primarily including dishes with dairy, fish, and chicken; and the "high carbon" category including beef and lamb dishes. These thresholds align with Broekema et al.'s (2020) proposal for a 2.04 kg CO_2eq per person per day food-related carbon budget to reduce food-related emissions by 2030. With these thresholds, one can eat many "low carbon" dishes and a medium quantity of "moderate carbon" dishes and stay within the budget. Setting the "high carbon" dishes to 1.0 kg CO_2eq or greater communicates that those dishes
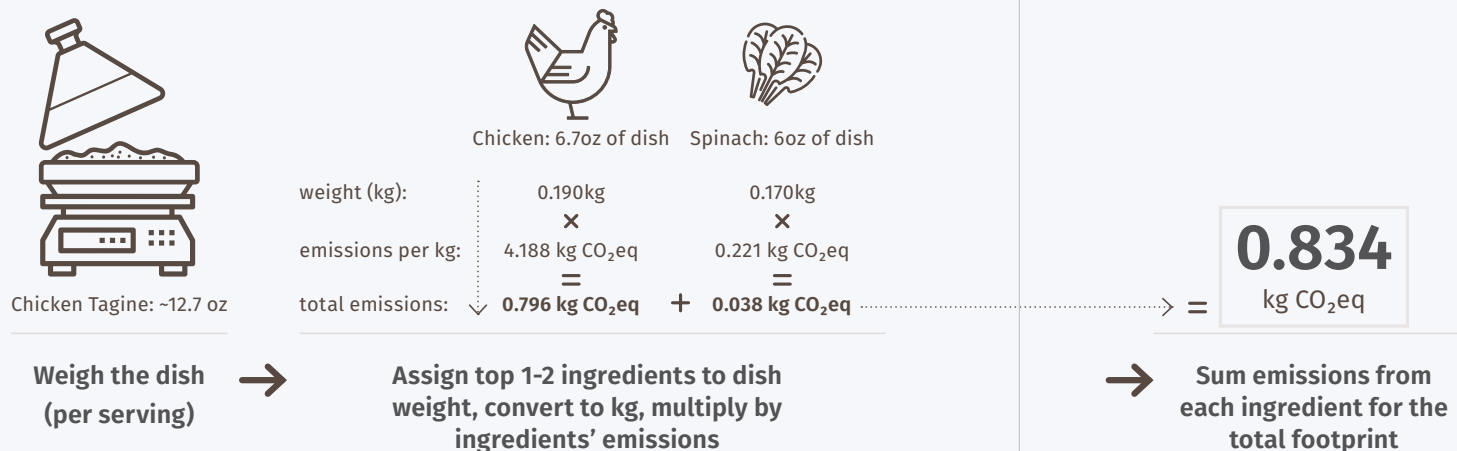

Chicken: 6.7oz of dish   Spinach: 6oz of dish

Chicken Tagine: ~12.7 oz

weight (kg):	0.190kg	0.170kg
	×	×
emissions per kg:	4.188 kg CO_2eq	0.221 kg CO_2eq
	=	=
total emissions:	0.796 kg CO_2eq	+ 0.038 kg CO_2eq

0.834
kg CO_2eq

Weigh the dish (per serving) →

Assign top 1-2 ingredients to dish weight, convert to kg, multiply by ingredients' emissions

→ **Sum emissions from each ingredient for the total footprint**

Figure 19.
Example dish calculation using data from Heller et al. (2018).

Dish	Carbon Emissions (kg co₂e/serving)	Serving Size
Mama Houria	0.016	1/4 of small container
Skordalia	0.030	1/4 of small container
Couscous	0.039	side container
Hummus	0.048	1/4 of small container
Zaalouk	0.054	1/4 of small container
Harissa Dip	0.066	1/4 of small container
Spice Roasted Cauliflower	0.076	1/2 of small container
Tunisian Salad	0.098	small container
Stuffed Grape Leaves	0.099	1/2 of small container
Root Vegetable and Date Tagine	0.101	whole container
Black Tea Saffron Rice Pudding	0.105	small container
Tzatziki	0.105	1/4 of small container
Tabboulah	0.119	small container
Toum	0.120	1/4 of small container
Rice	0.207	side container
Carthage Salad	0.256	whole container
Moroccan Lentil Soup	0.282	small container
Lablabi	0.351	whole container
Whipped Feta Rosso	0.363	1/4 of small container
Add Chicken to Salad	0.380	3.2oz
Whipped Feta	0.400	1/4 of small container
Spice Roasted Mushrooms	0.431	1/2 of small container
Greek Salad	0.504	whole container
Mujadara Rice	0.535	small container
Sun Salad	0.564	whole container
Bacalao Fish Pie	0.571	whole container
Lasagne Verde	0.609	whole container
Tunisian Egg Tagine	0.647	whole container
Chicken Tagine	0.834	whole container
Berber Terrine du Poulet	0.884	whole container
Chicken Chermoula w/ Rice	0.896	small container
Lasagna Bolognese	4.715	whole container
Merguez Meatballs	5.836	small container
Maghrebi Chili	6.250	whole container

Table 3. *Emissions calculations for each of El Harissa's dishes.*

consume at least half of one's daily food-related carbon budget. Additionally, carbon labels with similar thresholds are being tested in the University of Michigan dining halls at the time of this research (Lesli Hoey, pers. comm.). Although the two entities do not share the same customer base, having some alignment with adjacent research was deemed important.

Designing the Label

The "traffic light" carbon label was developed alongside the menu board and deli cards. As shown in Figure 20a, various compositions of dish names, descriptions, prices, and allergens were explored alongside carbon label concepts. From this experimentation with the label's color, placement, and iconography, we selected the concept incorporating a planet symbol to develop further, as we hypothesized that customers might be more likely to relate the implications of their food choices to the state of the planet over other symbols, such as a footprint or an abstract scale solely relying on color. Additional concepts incorporating the planet symbol were composed, some of which were influenced by design inspiration from Tunisia and Morocco that Yusef had contributed, as shown in Figure 20b.

The final label design, shown in Figures 21a and 21b, uses both color and border treatment to distinguish each tier. Manipulating the border afforded differentiation for customers with color vision deficiency and alludes to the quantity of emissions. The red, "high" tier has a thick border, representing no space for additional emissions. The yellow, "moderate" tier has tightly spaced dots surrounding the planet, representing some reduction in emissions. The green, "low" tier has loosely spaced dots surrounding the planet, representing a considerable reduction in emissions.

SUN SALAD — 14
Roasted sweet potato, spiced lentils, feta, pomegranate, almonds, and jammy dates on a bed of spring mix. House-made dressing: velvety tahini green curry.
d

MUJADARA RICE
Spiced green lentils and rice layered with carefully caramelized golden onions.
$7/12

SPICE ROASTED MUSHROOMS — 9.5/14
Succulent mushrooms coated in rice and chickpea flours and our North African spice mix. Served with Harissa Dip.

MERGUEZ MEATBALLS
Lamb + beef, onion, North African spice mix, tomato sauce. Served with choice of saffron rice or couscous.
e

ROOT VEGETABLE + DATE TAGINE
Sweet potato, parsnip, carrot, yukon gold potato, onion slowly braised with medjool dates, pomegranate molasses, coriander, and preserved lemon into tender, caramelized perfection. Served with choice of saffron rice or couscous.
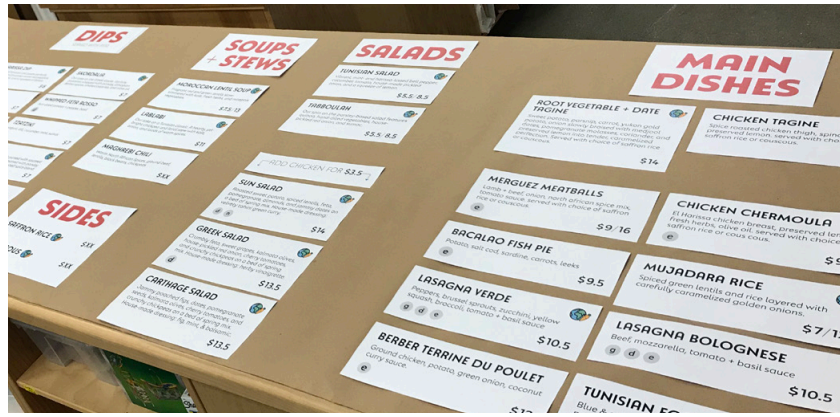
TUNISIAN EGG TAJINE — 9.5
Frittata-like egg pie dotted with blue and gold potato, peppers, spinach, feta, parmesan, mozzarella, and seasoned with herbs and spices. *contains egg, dairy*

MERGUEZ MEATBALLS — 9/16
North African-spiced lamb and beef in a rich tomato sauce, served with choice of rice or couscous.
contains egg

$9/16 $15

Figure 20a. *Carbon label exploration.*

ROOT VEGETABLE + DATE TAGINE
A savory-sweet marriage of slowly-braised carrots, parsnips, and potatoes with pomegranate molasses, dates, and tangy preserved lemon. With saffron rice or couscous.

Root Vegetable + Date Tagine
A savory-sweet marriage of slowly-braised carrots, parsnips, and potatoes with pomegranate molasses, dates, and tangy preserved lemon. With saffron rice or couscous.

TOUM
A bold, creamy garlic spread that you'll want to put on just about anything.
contains egg

Toum
A bold, creamy garlic spread that you'll want to put on just about anything.
contains egg

MERGUEZ MEATBALLS
North African-spiced lamb and beef in a rich tomato sauce, served with choice of rice or couscous.
contains egg

Merguez Meatballs
North African-spiced lamb and beef in a rich tomato sauce, served with choice of rice or couscous.
contains egg

Skordalia — 7
Tender, garlicky potatoes whipped with Ethiopian Berber spices and smoked paprika. Our take on a Greek staple.

Merguez Meatballs — 9/16
North African-spiced lamb and beef in a rich tomato sauce, served with choice of rice or couscous.
contains egg

Lablabi — 11
A hearty, yet bright chickpea and lentil stew with kale and loads of warm spices. A Tunisian classic with our own spin.

Zaalouk — 7
Fire-roasted eggplant pureed with sauteed tomatoes and onion. Seasoned with parsley and ras el hanout—our top-shelf spice blend.

Lasagne Bolognese — 10.5
Alternating layers of homemade lasagna noodles, minced beef, tomato basil sauce, and topped with mozzarella.
contains egg, dairy, gluten

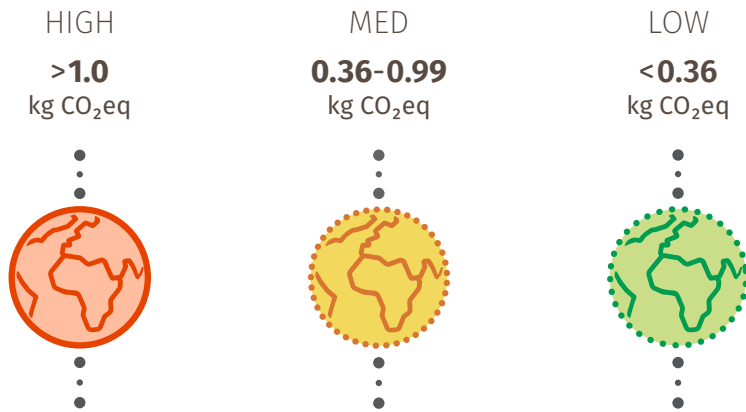**Figure 20b.** *Carbon label planet exploration.*

HIGH	MED	LOW
>1.0	**0.36-0.99**	**<0.36**
kg CO_2eq	kg CO_2eq	kg CO_2eq

Figure 21a. *Final carbon label design.*

Root Vegetable & Date Tagine   15
Savory-sweet slow-roasted carrot, parsnip, sweet and golden potato, caramelized onion, pomegranate molasses, Medjool dates, and tangy preserved lemon. Served with rice or couscous.

Berber Terrine du Poulet   12
Ground chicken with potato, green onion, and fenugreek baked into small loaves. Served with a citrusy coconut curry sauce.
contains egg

Merguez Meatballs   9 / 16
Inspired by the Maghrebi sausage, our spiced lamb and beef meatballs are hand-rolled with onions and herbs and coated with a thick tomato sauce. Served with saffron rice or couscous. *contains egg*
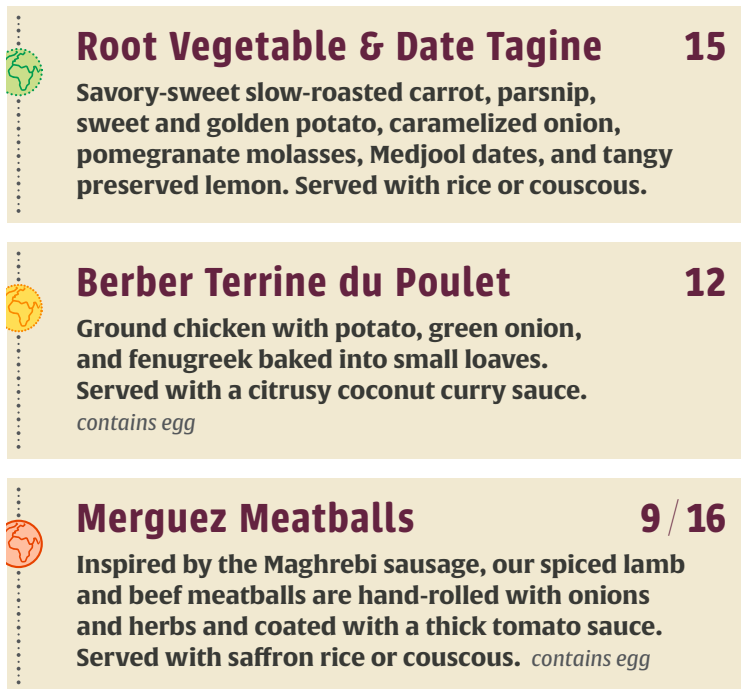
Figure 21b. *Menu tile detail.*

Descriptive Environmental Messaging

The menu board and the informational flyer incorporated descriptive messaging to support the carbon label and help customers put it into context. The lower-left corner of the menu board design includes a legend of the carbon tiers and a friendly message inviting customers to try a green-labeled dish, as shown in Figure 22. The message, inviting customers to "join us on our journey," was inspired by plant-rich messaging tested by the World Resources Institute (Blondin et al. 2022), which was shown to increase the selection of plant-rich choices.

We developed an informational flyer, shown in Figure 23, to be placed near the menu board to inform customers of the actions El Harissa is taking to be more environmentally sustainable and provide background on how the labels were calculated, including the table of emission from each dish (Table 3). We also developed two messages in the central paragraph of the flyer:

1. *We're happy to share that over half of our dishes have a low carbon footprint, so you can savor our food while saving the planet.*

2. *Reference our carbon labels next time you order and make a difference through your food choices. Swapping just one red dish for a green dish can save greenhouse gas emissions that are equivalent to a 13-hour Netflix binge! Your small change can make a big difference.*

These two messages were also adapted from Blondin et al. (2022). Message 1 alludes to the taste benefits of El Harissa's dishes. Message 2 contextualizes the impact of making a change in terms of an everyday activity, which was calculated by taking the emissions savings from selecting the Root Vegetable & Date Tagine over the Merguez Meatballs and dividing it by the per-hour emissions of using a streaming service as estimated by Shehabi, Walker, and Masanet (2014).

Ann Arborites are making changes to eat more sustainably, and so are we!
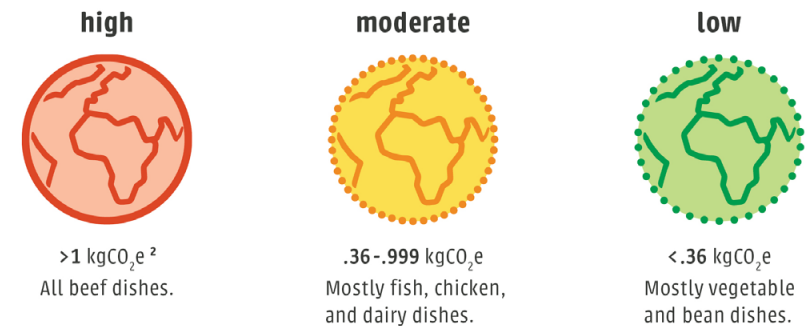
high   moderate   low

Join us on our journey and try our green dishes, which have a low carbon footprint and are kinder to the planet.

Figure 22. *Carbon label legend.*

At El Harissa, we're taking steps to make our business more environmentally sustainable.

Growing plants and raising animals emit greenhouse gases that contribute to climate change, but not all sources of food have equal impact.

So, we calculated[1] the carbon footprint for each of our dishes to see how they stack up. We found that our dishes fall into 3 categories:

high	moderate	low
>1 $kgCO_2e$ [2]	.36 – .999 $kgCO_2e$	<.36 $kgCO_2e$
All beef dishes.	Mostly fish, chicken, and dairy dishes.	Mostly vegetable and bean dishes.

We're happy to share that over half of our dishes have a low carbon footprint, so you can savor our food while saving the planet. Reference our carbon labels next time you order and make a difference through your food choices. Swapping just one red dish for a green dish can save greenhouse gas emissions that are equivalent to a 13-hour Netflix binge![3] Your small change can make a big difference.

Questions? Feedback? Contact Stephanie Szemetylo (stephsz@umich.edu)

[1]**How was this calculated?**
We used Life Cycle Assessment (LCA) to calculate the the carbon footprint for each dish. We took each recipe and linked its primary ingredients with emissions data, which accounts for the greenhouse gases emitted from raising crops and livestock (e.g. from fertilizer production to cow burps). Then we adjusted the footprint for serving size. See the table on the back for the footprints for all 34 of our dishes!

[2]Carbon dioxide equivalents ($kgCO_2e$) are used to standardize the potency of various greenhouse gases

[3]Comparing emissions of our Root Vegetable & Date Tagine and Merguez Meatballs with streaming LCA data from Shehabi, Walker, and Masanet (2014)

Figure 23. *Informational flyer.*

Phase 5: Evaluation

The menu board, deli cards, and informational flyer were implemented in El Harissa as a field experiment on March 28, 2022. Quantitative and qualitative data were collected from Tuesday, March 29 through Sunday, April 10, 2022, and analyzed to answer the following evaluation framework questions from DfSB (Lilley and Wilson 2017):

Does the design intervention function for the specified context?

This question assesses the usability of the intervention materials and whether they operate as intended. In general, we aimed to establish that the materials were legible and functioned as tools that customers use to make a food selection. For the carbon labels and descriptive environmental messaging, we aimed to determine whether customers understood the meaning behind the labels and could distinguish between the three tiers. For the enhanced menu item descriptions, we aimed to determine whether taste- and preparation-forward descriptors afforded a more complete image of the dish in the customer's mind when ordering.

Is the user's behavior change sustainable (ecologically, socially, economically)?

This question assesses whether the resultant change in behavior is sustainable from ecological, social, and economic perspectives. From an ecological perspective, we aimed to determine whether there was a change in the average emissions per ordered dish between pre and post-implementation. From a social perspective, we aimed to determine whether the intervention brought up any positive or negative reactions that may impact future patronage. From an economic perspective, we aimed to determine whether the resultant behavior change affected El Harissa's total sales.

Has the user's behavior changed as a consequence of the design intervention? Has the intervention changed the habitual behavior of the user?

These questions assess the intervention's ability to change the customer's purchasing behavior, particularly over the long term. Demonstrating the durability of the behavior change was limited due to the time constraints of the project and the fact that El Harissa's customers are not a fixed cohort of research participants. Due to the nature of the intervention context, it was difficult to determine whether a specific customer had turned plant-rich meal-ordering into a habit or has translated the habit to their food decisions in other contexts without longer-term, more extensive research methods. Despite these constraints, we aimed to determine whether customer food selections changed due to the design intervention in the short term by comparing pre and post-intervention sales data, observing customers and staff interactions, conducting brief exit interviews with customers and staff, and a brief customer exit survey.

Evaluation Methods

The following data collection methods were employed to inform the evaluation.

Collection and Comparison of Sales Data

The sales of El Harissa's dishes during the implementation period were compared with the two-week period immediately preceding the implementation period (i.e., Tuesday, March 15 through Sunday, March 27, 2022) and the same two-week period from the prior year (i.e., Tuesday, March 30 through Sunday, April 11, 2021). Sales data were collected from the restaurant's point of sale system. Collecting this quantitative data enabled us to record the potential shift in the number of dishes sold within each carbon label tier, calculate the change in total emissions and average emissions per dish sold, and any financial impacts.

Activities	• *How do customers approach the deli counter and order with the design intervention?* • *How do customers read over the menu? Do they take the informational flyer?* • *Do customers appear to choose lower carbon dishes due to the interventions?*
Environments	• *How does the menu board affect the flow of customers in the restaurant space?*
Interactions	• *In what ways do customers react to the new menu and interventions?* • *What kinds of questions and comments do customers have?* • *Does the design intervention prompt conversation between customers and/or between customers and staff?*
Objects	• *Are customers able to read the menu board and deli cards?* • *Do customers understand the carbon labeling and environmental messaging?*
Users	• *Which customers appear to be more influenced by the design interventions?* • *Does the design intervention impact different customers in different ways?*

Table 4. *AEIOU framework for observing the design interventions.*

Customer Exit Survey

A four-question exit survey was implemented to determine whether customers understood the interventions, whether the interventions influenced their choices, and collected open-ended feedback and questions about the menu design. Paper surveys were placed by the register for customers to fill out while waiting for their order, along with a QR code poster linking to an online version of the survey. This timing of the survey was chosen so that customers could immediately reflect on their choices after ordering. These materials are located in the Appendix.

Observation Sessions

I conducted seven two-hour observation sessions at El Harissa during the implementation period, where I was situated in the seating area at the restaurant's entry. As in the observation sessions in the Understanding *Users in Context* phase, I employed the Activities, Environments, Interactions, Objects, and Users framework (Martin and Hanington 2012) to structure these observations, as illustrated in Table 4.

Exit Interviews with Customers, Staff, and Yusef

During the observation sessions at El Harissa, I conducted brief, semi-structured exit interviews with interested customers and staff. Interested customers were directed to me by Yusef or a staff member after ordering or receiving their order. I first fielded general feedback from each customer interviewee and answered questions they may have had about the design interventions and the project more broadly. With their verbal permission, I inquired about how they interpreted and reacted to the carbon labels and environmental messaging, whether the menu descriptions sounded more enticing to them, how they decided what to order that day, whether the menu functioned to their expectations, and if learning about the impacts of food choices might

change what they order in the future. A full list of these questions is in the appendix. Not every customer was asked every question and these brief conversations followed topics relevant to a particular customer interviewee.

During slower times in the observation sessions, I was able to have brief semi-structured conversations with Yusef and staff members about their experience with the design intervention materials. These interviews aimed to identify usability issues, collect first-hand encounters with customers interacting with the intervention materials, and understand if the interventions had any influence on their work. A full list of these questions is in the appendix. Not every staff member was asked every question and these brief conversations followed topics relevant to a particular staff interviewee. Additionally, Yusef and I held an hour-long debriefing discussion after the data collection period to discuss our overall observations from implementation. These discussion questions are located in the appendix.

Ethical Considerations Throughout the Design Process

Integrating ethical considerations into the DfSB design process is critical. It is possible that the intended behavior change prescribed through the design intervention to reduce the GHG emissions of food choices may not be in line with the expectations and values of the customer (Wilson, Bhamra, and Lilley 2016). We explicitly chose intervention strategies that did not take away customer choice. However, it is possible that customers would have an adverse reaction to the carbon labels, such as guilt, and reduce patronizing the restaurant, impacting its economic sustainability. Yusef and his staff framed the carbon labels as a pilot for curious customers to hedge that risk.

The designer's motivations and intentions also need to be examined, as well as the methods used in the design process (Wilson, Bhamra, and Lilley 2016). In essence, my motivation for this project was to employ design methods to enable less resource-intensive consumption patterns and do so collaboratively. The research methods conducted throughout this process were either exempt from full IRB review or did not qualify for review, as I did not work with a vulnerable population. Any participation from Yusef, staff, and customers was completely voluntary, and they could modify their participation at any time.
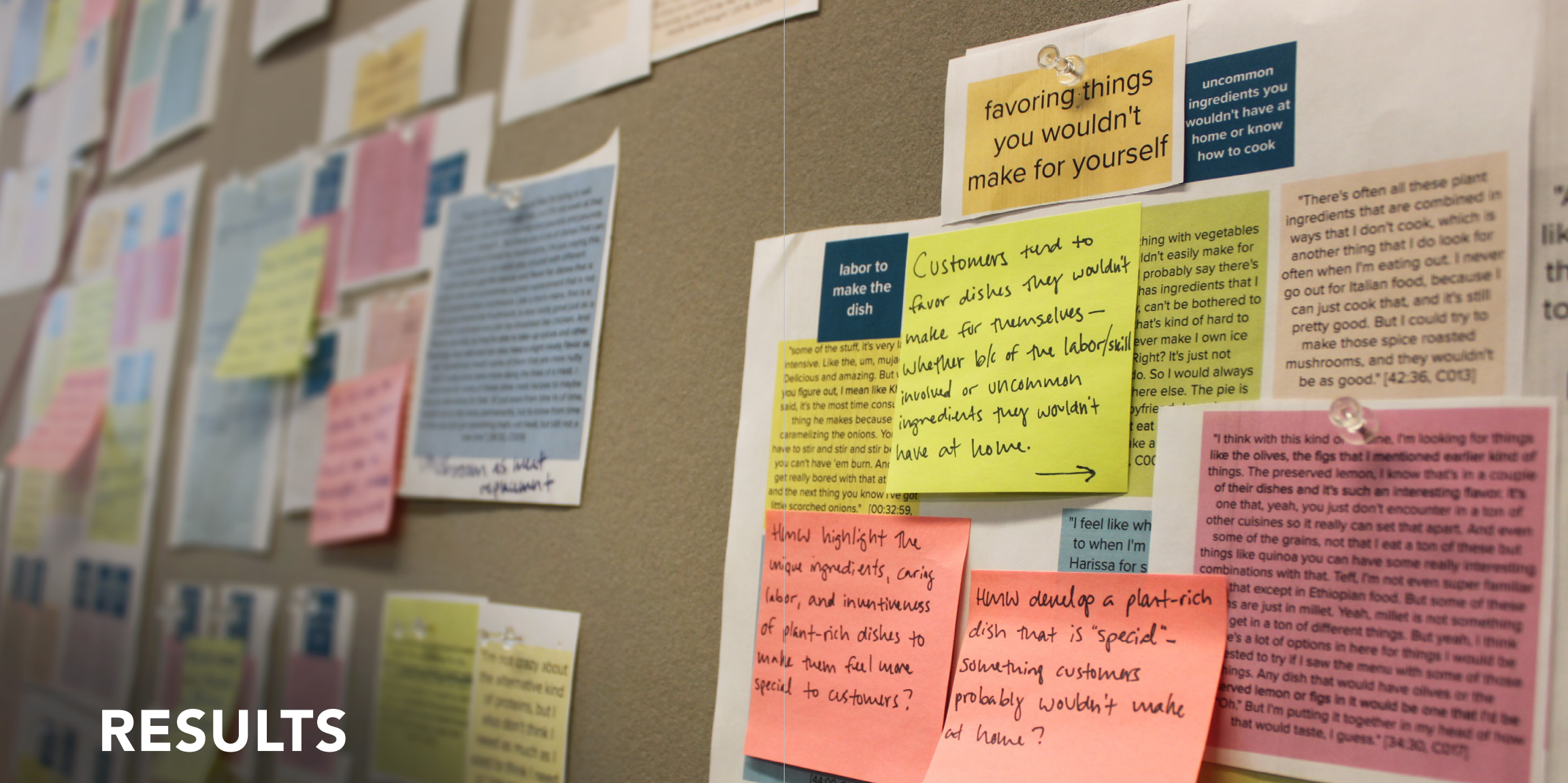
RESULTS

Phase 1: Understanding Users in Context

Observation Analysis and Findings

Observing El Harissa's brick-and-mortar location and the two weekly stations on the U-M campus yielded unique findings between these differing contexts. Tables 5a and 5b illustrate a summary of the most relevant observations and implications for the subsequent steps of this project.

AEIOU Code	Observation			Implication(s)
Activities Environments Interactions Objects Users	The placement of the deli counter and ordering area combined with an undefined queueing area visually obstructs the options in the deli case			Might a printed menu or a large menu board help minimize the ordering wait time and act as a medium to include an intervention?
Activities Environments Users	Customers experience two phases of "dwell time" during their visit: waiting to place an order and waiting for the order to be ready			Might those "dwell times" be leveraged for an informational behavior change intervention?
Interactions Objects Users	Some customers awkwardly squat or lean over the deli case to peruse the options and then stand and lean into the small printed menu atop the case to check prices.			Might a printed menu or large menu board be a more accessible medium to view El Harissa's options? Follow up on customer experience with the deli case in the interviews.
Activities Interactions Users	El Harissa's staff are the gateway to educating both new and regular customers on their cuisine and what to order			How might these interactions influence customer choices? Follow up during customer interviews and conversations with Yusef.
Activities Interactions Users	Call-in orders came in regularly during the observation sessions. From what I could gather, customers had a clear idea of what to order before calling, and the interactions with staff were much shorter than in-person ordering.			Probe customers on their experience ordering over the phone. Might the online menu be a point of intervention?

Table 5a. *Key observations from El Harissa's brick and mortar location.*

AEIOU Code	Observation		Implication(s)
Interactions Users	Yusef follows a "script" to introduce the cuisine to potential customers. Often he described the Root Vegetable and Date Tagine last, introducing the dish as "our vegan dish," and then describing the ingredients.		Might the order and style in which Yusef and his staff talk about their plant-rich dishes influence their customers?
Interactions Objects Users	El Harissa's menus, displayed on a TV, are far enough from their station where customers have difficulty connecting the two.		A smaller print menu or cards at the station could help and could include an informational intervention
Environments Users	Both of El Harissa's stations at U-M have spatial challenges: one is situated in the back of a cafe where students can miss it, while the station in the other cafe is right at the entry where students bypass it.		Interesting, but not entirely relevant to the scope of the project

Table 5b. *Key observations at El Harissa's stations at U-M.*

Interview Analysis and Findings

The most relevant findings from the interviews with Yusef and El Harissa's customers are represented in Tables 6a and 6b. Each finding links back to the Understanding Users in Context research objectives described in the methodology and reflects on strategy selection and design implications.

Test Kitchen and *Describe Your Dish* Findings

The generative activities conducted with El Harissa customers yielded valuable insights, some of which are reflected in Table 6b. Participant enthusiasm for the activity was mixed, with some excited to engage in a creative activity and other participants experiencing technical difficulties with Zoom or MURAL. Others felt they lacked the creativity to come up with "good foods" and cited that as a reason for frequently dining out.

The Test Kitchen generated three groupings of findings. First, the activity revealed ingredient, texture, and other food preferences. These interviews occurred in November, which may have led participants to choose ingredients associated with fall and winter dishes, highlighting that seasonality may be a factor when coming up with a new plant-rich dish. Participants crafted dishes that combined contrasting textures (i.e., smooth with crispy) and balanced different flavor profiles (i.e., spicy and tangy). Participants were not particularly adventurous

Objective	Finding		Implication(s) for Strategy Selection and Design
(2) Understanding the environmental impact of animal products	Yusef had some familiarity with the impacts of animal-sourced foods, particularly beef, but had not realized that lamb and goat, which are also ruminant animals, emit roughly the same amount of greenhouse gasses.		Calculating the carbon footprint of his dishes may illuminate the impacts of the dishes that El Harissa serves.
(1) How their menu is developed, (4) Barriers and enablers to create and promote plant-rich dishes	Though there is interest in creating new plant-rich dishes, operational barriers are in the way: time and creative energy to develop new dishes, staffing shortages, and physically fitting more dishes into their deli case.		Strategies to increase the relative number of plant-rich dishes may not be feasible at this time.
(4) Barriers and enablers to create and promote plant-rich dishes, (5) Changes El-H might make to encourage plant-rich choices	El Harissa's meat dishes account for only 20% of the menu, yet they are consistently top sellers. Cutting those dishes from the menu would have a significant economic impact.		Forcing strategies would not be an appropriate direction at this time.
(3) Perspective on plant-rich diets and dishes	Yusef has described his customers as being "sustainably-minded," and estimates 20% of customers are vegetarian or vegan, with a growing segment appearing to be flexitarians or meat reducers.		El Harissa customers may be more receptive to a behavior change intervention than other area restaurants
(4) Barriers and enablers to create and promote plant-rich dishes	Yusef has built up an intuition of how to sell a particular dish to a customer, whether highlighting ingredients, healthfulness, or another attribute.		Could the way Yusef and his staff describe dishes be leveraged?

Table 6a. *Key findings from interviews with Yusef.*

Objective	Finding			Implication(s) for Strategy Selection and Design
(1) Decision-making process and considerations when ordering	Customers do not always have a firm plan of what to order when entering El Harissa and could be persuaded by staff recommendations, availability, the visual presentation of options, or a combination thereof.			This flexibility could be swayed by another level of information, such as a carbon label, or could be nudged via staff recommendation.
(1) Decision-making process, (4) Barriers and enablers for selecting plant-rich dishes	Customers, especially newer customers, have to parse through a lot of information when they approach the deli case.			Consider how an informational intervention could be presented alongside other information, such as allergens and price.
(1) Decision-making process and considerations when ordering, (4) Barriers and enablers for selecting plant-rich dishes	Customers review the ingredient list on each deli card to understand flavor profiles, educate themselves about the cuisine, filter options, and check for allergies/sensitivities. However, because the list is just that—a list—newer customers were unsure of what to expect in some dishes.			Developing a fuller description of the dish could satisfy unfamiliar customers and draw others in with more appealing language.
(2) Understanding of environmental impacts of animal products, (3) Attitudes towards plant-rich diets	Many customers have some awareness of animal products' impact on climate change. However, for customers who identify as meat-eaters or flexitarians, reducing their meat consumption in restaurants takes a backseat to taste, treating oneself, dietary restrictions, and meat-centric menus.			Having information about the climate change impacts of animal products is not enough to overcome these barriers, and nudging strategies may be more effective.
(4) Barriers and enablers for selecting plant-rich dishes	Customers tend to favor dishes they wouldn't make for themselves because of the labor and skill involved or uncommon ingredients. Inversely, customers avoid dishes they could make at home or do not "wow" them.			Highlighting the unique ingredients, caring labor, and inventiveness may make them feel more special to customers.
(5) Attitudes towards sustainability initiatives	Customers respect El Harissa's participation in the returnable container pilot and how they embed values into their business on top of having great food. Because of this, customers are more inclined to support them.			Customers appear to be open to having El Harissa take on more sustainability initiatives.

Table 6b. *Key findings from customer interviews.*

with spices. Participants were uncertain how to combine them but trusted El Harissa to skillfully incorporate various spices into their offerings.

Second, the activity brought up other aspects they consider when ordering. As noted in Table 6b, a few participants said they prefer to order dishes that they would not be bothered to make themselves at home. They pointed out *Test Kitchen* ingredients they likely would not have at home, such as harissa or preserved lemon. Participants also described labor-intensive tasks that would make preparing a particular dish a nuisance, such as perfectly caramelizing onions or removing pomegranate seeds, and said they would opt to have the restaurant handle that. Not too surprisingly, all plant-rich dish concepts incorporated colorful vegetables. Participants mentioned being drawn to bright colors and described how it has influenced what they selected from the deli case, the bright color of the restaurant's Harissa Dip being noted in particular.

Finally, the activity generated discussion about beliefs about meat consumption and experience with plant-rich diets. Participants who have reduced their meat consumption largely cited environmental impact, animal welfare, and health concerns as primary reasons. Participants who have attempted to reduce their meat consumption cited barriers including taste, habit, cultural reinforcement, and having the time and skill to make different recipes. Additionally, including plant-based meat and dairy alternatives in the *Test Kitchen* board initiated discussion of those ingredients, which were largely absent from participants' concepts. The omnivore-identifying participants felt that these alternatives fall short of real meat and prefer vegetarian and vegan dishes not to imitate meat dishes. Other participants had concerns that these alternatives contain allergens or are highly processed. Therefore, if El Harissa were to develop new plant-rich dishes, they should lean on minimally processed plant ingredients and not imitate meat dishes.

The *Describe Your Dish* activity helped participants articulate the preparation methods once ingredients were selected to create a complete dish concept. Repeating the activity over sixteen participants revealed common descriptors that could be incorporated into the menu or into the preparation of a new dish. The most frequently occurring descriptor was "caramelized," and many participants spoke positively about that term. Though many of the concepts were vegan, some participants were hesitant to give their concept that label, reasoning that it may dissuade non-vegans from selecting it. The term "local" also generated discussion and yielded various interpretations, such as originating within a particular geographic radius or region or supporting smaller, decentralized farms and businesses.

The customer interviews and generative activities brought forward additional findings beyond this project's scope. Participants often brought up opportunities to improve the customer experience, such as communicating the sizes of dishes on the restaurant's website. Participants also discussed their desire for area restaurants to source local ingredients and reduced packaging, both relevant to food and sustainability, but not the aim of this thesis. The wealth of dish concepts created by participants and these additional findings will be made available to El Harissa for future consideration.

Phases 2, 3, & 4: Co-Designing Target Behavior Specification, Strategy Selection, and Production of Intervention Solutions

The integration of Co-Design into the DfSB design process, particularly in Phases 2, 3, and 4 with Yusef, led to valuable outcomes that are worthy of elaboration. As described in the contextual review, the DfSB process lacks the comprehensive involvement of stakeholders. Participation is typically limited to end-users during the first and final stages of the process and to broader stakeholders when considering the ethical implications of a project (Lilley et al. 2018; Wilson 2013).

Engaging Yusef in Phase 2: *Specifying Target Behavior* and Phase 3: *Selecting Intervention Strategies* integrated his expertise in running his family's restaurant business, reduced my assumptions in the design process, and led to more informed and realistic intervention decisions than had he been less involved. After developing the customer journey maps in Phase 2, I initially assumed Yusef's comfort level by suggesting that we conduct a series of smaller experiments within the local restaurant stations inside the two University of Michigan unions as a low-risk means of testing various design interventions. However, Yusef countered this assumption by readily welcoming a larger design intervention in El Harissa's brick-and-mortar location to reach more customers. In Phase 3, the realities of running El Harissa heavily influenced the strategies Yusef and I selected for this project. For example, Yusef highlighted many factors for developing new dishes that would make that strategy an improper fit for this project's timeline: taking time and creative energy to develop new dishes, integrating new dishes with their current offerings, and training staff to prepare them. Potential economic risk was another factor, and we therefore decided to eliminate forcing strategies from our strategy considerations.

Phase 4, *Produce Intervention Solutions*, cultivated shared ownership of the intervention development process and built Yusef's capacity to sustain the interventions we designed beyond this project. After I made him aware of the *Appealing Menu Language* intervention strategy, he started incorporating some of the popular descriptors from the *Describe Your Dish* activity into his recommendations to customers. For example, when describing the Root Vegetable and Date Tagine to his student customers at U-M, he emphasized the caramelization in the cooking process and the use of unique ingredients, such as pomegranate molasses. He also started applying this strategy on his own to describe new dishes on the menu before we even started writing our "official" intervention descriptions.

Collaboratively calculating the carbon footprint of each dish resulted in co-benefits for Yusef. At first, collecting the necessary information to calculate the carbon footprint of each dish was a nuisance for him, but he later remarked on how having updated information on the ingredient weights for each recipe would ultimately be very useful for business planning purposes. The carbon calculations themselves had some surprises. Both of us were surprised to learn that the emissions of their mushroom dish fell under the "moderate" carbon level, on par with some of the chicken and dairy dishes. Examining each dish together built his awareness of the impacts of his menu offerings, which he can apply to future internal decisions or share externally with his customers.

Phase 5: Evaluation

The results of the evaluation phase are organized by the data collection method and then discussed using the evaluation framework questions from DfSB (Lilley and Wilson 2017).

Changes in Sales Data

The sales of El Harissa's dishes during the intervention period (i.e., Tuesday, March 29, through Sunday, April 10, 2022) were compared with a two-week prior baseline (i.e., Tuesday, March 15 through Sunday, March 27, 2022) and a one-year prior baseline (i.e., Tuesday, March 30 through Sunday, April 11, 2021). To respect the proprietary nature of this data and at the request of El Harissa, I will not disclose the revenue and net dishes sold, but it is worth noting that these metrics did not vary widely among the three periods, suggesting that the intervention did not have a negative financial impact. The share of dishes within each carbon label tier also did not vary significantly, with the green ("low") tier representing 55.1–55.7% of sales, the yellow ("moderate") tier representing 35.7–36.7%, and the red ("high") tier representing 7.66–8.9%, as shown in Figure 24. There was a slight increase in the proportion of high carbon dishes sold during the two-week baseline and the intervention period compared to the one-year baseline, likely due to the addition of the Maghrebi Chili in the fall of 2021, which was calculated as red-labeled dish.

Emissions were calculated as an average to accommodate the variation in the number of dishes sold during the three periods. The average emissions per as-sold dish (i.e., not adjusted for serving size as depicted in Table 3) during the intervention period was 1.149 kg CO₂eq, 2% less than the two-week baseline and 7% more than the one-year baseline, again, likely due to the addition of the Maghrebi Chili. Additional
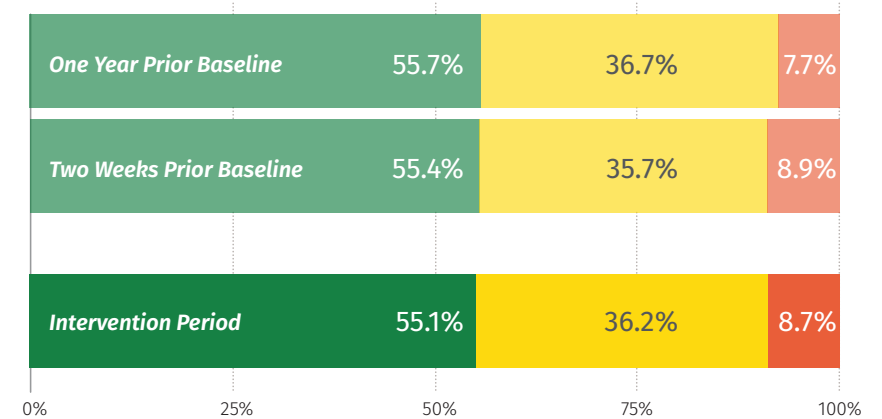

Figure 24. *Share of dish sales by carbon label tier.*

analysis revealed that while the quantity of entrees[2] sold increased by 4% during the intervention period compared to the preceding two weeks, total emissions of those dishes declined by 1%. This shift may be explained by a 3% decline in the overall quantity of meatballs served, one of El Harissa's most GHG-intensive dishes, between the two periods, suggesting that customers may have selected lower carbon dishes due to the label.

Observation Sessions

I conducted seven observation sessions throughout the two-week intervention period, about two hours for each session and alternating between lunch hours and dinner hours. An estimated 79 transactions were observed. The most noticeable observation was how regular customers approached the deli counter compared to newer customers. I was able to discern between these two groups based on overheard conversations with Yusef or other staff members waiting on them. While newer customers tended to look up at the menu board to view options, regular customers ignored the menu board and ordered

[2] The entree category here refers to El Harissa's categorization of dishes in their point-of-sale system, not what is represented in the menu board design intervention.

directly from the case, frequently by squatting down and pointing at dishes. A handful of regular customers appeared to know exactly what they wanted to order based on how they interacted with staff. Of the 56 in-person food transactions observed (excluding gelato orders, market items, and call-in orders), only 17 customers (30.4%) referenced the board. Relatedly, customers looking at the menu board afforded cues to staff that they were likely new, which appeared to help the staff frame conversations with those customers.

We implemented the menu board with the hypothesis that customers would view it while waiting for customers ahead of them at the deli case. There were not many instances where a queue formed, but when a line developed, queued customers did look up and scan the menu board. After ordering, customers' "dwell time" was primarily spent perusing the market rather than looking at the menu board or taking the informational sheet.

From what could be discerned over the hum of the gelato and deli cases, customers who did make remarks about the menu interventions seemed positive. On two separate occasions, new customers reacted to some of the descriptions with intrigue. Upon reading the description for Mama Houria, a customer said with positive intrigue, "I read the description and was like, oh my god, what is that?!" Another customer commented to a staff member that she likes to read all of the options before making a decision. When Yusef or Susan would point out the new menu board, customers reacted positively.

Customer Exit Survey Results

Twenty self-selected respondents completed the survey during the two-week period. Nineteen respondents completed the paper survey, while one completed the survey in Qualtrics. Of the 20 respondents, 15 (75%) understood the carbon label, 2 (10%) did not understand

the label, and 3 (15%) did not notice the label. Of the 15 respondents who did understand the label, 6 (40%) did not consider the label, 4 (26.67%) did consider the label, but it ultimately did not affect their choices, 4 (26.67%) indicated that they ordered a lower carbon dish than they otherwise would have, and 1 (6.67%) ordered a higher dish than they otherwise would have. These preliminary results indicate that implementing a carbon label to encourage the selection of low-carbon, plant-rich dishes is effective about 25% of the time when understood by customers.

Regarding the effectiveness of the appealing menu language, 6 (30%) indicated that their food choices were influenced by the new descriptions, 10 (50%) were not influenced, and 4 (20%) did not notice the descriptions. The five respondents who either did not understand the carbon labels or did not notice them also did not notice the descriptions or were influenced by them. Of the six respondents who understood the label but were not influenced by it, only one indicated that the new descriptions influenced their ordering. Of the four respondents who considered the labels but were not ultimately influenced by them, three indicated that the new descriptions were influential. It is possible that many of the respondents are regulars and already have familiarity with the menu and therefore did not notice the descriptions or need a description to make a decision.

At the end of the survey, the open-ended question yielded positive remarks about the new menu board, ranging from an appreciation for a new menu design to the helpfulness of the descriptions and carbon labels. A few respondents wrote comments on other questions, mentioning that they did not notice the carbon labels until after ordering but thought they would be useful in the future.

Exit Interviews

Customer Ad-hoc Interviews

Customer participation in the ad-hoc interviews was limited, with only two participants. When asked about the labels, both participants said they did not impact their orders, as one made a phone order and was unaware of the new menu design. The other overlooked the labels, thinking they indicated spice levels, and simply ordered what sounded good to him. The participant who ordered over the phone thought that the labels could impact future ordering and recommended that the carbon dioxide equivalents (kg CO2e) be spelled out on the handout. Both participants thought that the board was easy to read and functioned well.

Staff Ad-hoc Interviews

Three front-of-house staff were interviewed at the end of their shifts during the implementation period. All three staff members appreciated the utility of the menu board and deli cards. One staff member, in particular, valued the consistent design of the cards and believed it allows customers to more easily compare dishes and shows off the dishes better than the handwritten cards. As found in the observation sessions, a staff member recognized when customers were new when they looked up at the menu board. Having this information helped prepare staff to guide customers in the ordering process.

The three had some feedback to improve the menu materials and the interventions. One staff member felt bad that she had to break the news to customers who were ordering from the board that an item was out of stock. She wondered if it was possible to indicate on the board if an item was out of stock in order to set expectations with customers. The staff thought the descriptions were helpful but perhaps too long for customers to read through. One staff member observed that customers asked fewer questions with the new descriptions and was unsure if that was a positive or negative outcome.

The staff also provided feedback on the carbon labels. One staff member thought the label could use a stronger indication of what each tier means, possibly spelling out "low, mod, high" on the card or some other means to denote it. She also thought that including a legend on the case in addition to the legend on the menu board would help customers make sense of the labels. Like one of the customer participants, another staff member thought the carbon label could be interpreted as spice level due to the red-yellow-green color choices and thought that newer customers might interpret that similarly, assuming that North African cuisine is spicy.

Debriefing Interview with Yusef

Yusef and I engaged in an hour-long debriefing session to discuss his observations soon after the implementation period. From Yusef's perspective, reactions to the intervention materials were positive. The menu board and the inclusion of the enhanced descriptions were beneficial for first-time customers who could acquaint themselves with El Harissa's cuisine while waiting to order. This intervention saved the time Yusef and his staff would normally invest in describing unfamiliar dishes to newcomers.

Customers made positive comments about the introduction of the carbon labeling system and were excited that El Harissa was testing this. However, it was not clear to Yusef whether customers were using this provision of information to make a lower carbon choice or if customers simply thought the carbon information was "nice to know." Furthermore, it appeared that customers understood the labels only when they had the time and curiosity to digest the meaning of the labels or had Yusef or a staff member introduce the labels

outright. Yusef also hypothesized that the planet design could have been overlooked because it may have been interpreted as a "design flair" rather than a graphic conveying information. A few customers came up with their own meanings as well, in addition to the "spicy" interpretation. Customers associated the use of red with "red meat" and the use of green with "vegan" but did not make the connection between the types of foods and environmental impact.

These findings from our debriefing discussion suggest three main implications for future work. First, as described in the contextual review, *informing* strategies such as carbon labels are only one of many strategies to guide behavior change and have been criticized for their underlying assumption that individuals have the time and competency to understand feedback metrics and the ability to act upon them (Hazas, Brush, and Scott 2012). Perhaps carbon labels should not be expected to shift a customer's food choice instantly. For example, a very hungry customer may enter El Harissa and overlook the carbon labels but may be influenced by the affordances embedded in the taste-, texture-, and provenance-forward description of their Skordalia, a low-carbon, plant-rich dish:

> *Smooth and garlicky potatoes whipped with Ethiopian Berbere spices and smoked paprika. Great with bread or as a flavorful mashed potato side.*

In a future visit, this customer might have the time to peruse the labels and select another lower-carbon dish. This consideration is why Yusef and I paired carbon labeling and appealing menu language in this project. Within El Harissa and other restaurant contexts attempting to shift customer behavior, a constellation of design interventions that leverage different aspects of the decision-making environment may be more effective than a single intervention, such as combining descriptive environmental messaging with choice architecture and decreasing the proportion of meat in a dish, for example.

Second, customers' interactions with staff can play a crucial role in supporting this constellation of interventions, whether it includes carbon labeling or otherwise. Staff involvement can continue in the form of introducing the carbon label and answering customer questions about the carbon labels, or, more actively, staff can recommend their favorite plant-rich dishes. DfSB could further explore these interpersonal moments to reduce meat consumption or other resource-intensive behaviors.

Finally, more design exploration is required to develop a carbon labeling system that can be readily interpreted and acted upon by customers. Composing future iterations that experiment with a label's visibility, form, color, and other characteristics should be done with El Harissa's customers to create an indicator that is more recognizable and actionable to them.

Everything described above pertains to El Harissa's customers, yet the perspective of El Harissa's owners on these inverventions is equally important, if not more important, because they are the stakeholders who have taken the risk to implement them. Although Yusef was open to experimenting with a three-tier carbon labeling system in this project, one of his family members was not entirely pleased with seeing their restaurants' top-selling dishes in the red, high-carbon tier. Therefore, there is some reasonable hesitation about maintaining the three-tier carbon labeling system beyond this project, even though the intervention did not appear to negatively impact the restaurant's overall sales. A single-tier carbon label system may be explored in the future as an alternative.

Did the design intervention function for the specified context?

In a general sense, the menu board, deli cards, and informational flyer functioned as intended, and there were no major malfunctions in the implementation period. The menu board and deli cards functioned as tools to help customers make a food selection, though we deemed that the deli card design could have benefitted from a larger font size. The customer survey indicated that 75% of respondents understood the carbon label; however, we recognize that the survey sample was small and voluntary. There is also potential for the label to be misinterpreted for spiciness levels, and the implementation of the label on the deli cards could have had more visual strength and more substantial differentiation between the tiers. The appealing menu language only influenced 30% of survey respondents but appeared to help customers better understand the cuisine, as Yusef and a staff member observed fewer questions being asked.

Is the change in the user's behavior sustainable (ecologically, socially, economically)?

A comparison of sales data during the two-week implementation period with the preceding two weeks shows a 2% decrease in average as-sold dish emissions, with the number of dishes sold remaining similar. Customer reactions to the new menu board and deli cards were primarily positive and neutral at worst, so it can be inferred that the intervention has had a positive social impact. All remarks on the open-ended question at the end of the survey were positive, with one respondent sounding proud of El Harissa's commitment to educating and encouraging more sustainable choices. Again, however, this survey was voluntary, and customers less amenable to carbon labels may not have bothered taking the survey.

Has the user's behavior changed as a consequence of the design intervention? Has the intervention changed the habitual behavior of the user?

Comparing the sales data shows that customers purchased more entrees during the implementation period than in the preceding two weeks, yet the total emissions for those sold dishes were less than that same category's total emissions in the preceding two weeks. This suggests that customers may have used the carbon labels to inform a swap of a red dish for a yellow dish. As described in the methodology, demonstrating the long-term effectiveness of the behavior change was limited due to the time constraints of the project and the fact that El Harissa's customers are not a fixed cohort of research participants. However, the customer exit survey shows that a little over half of the respondents who understood the label considered it. A more extended implementation period would provide more resolution to answer this question.

DISCUSSION

Research Question: How might Design for Sustainable Behavior and Co-Design be used as integrative design methods to develop and implement behavior change strategies to reduce meat consumption in a local restaurant, such as El Harissa?

The behavior change interventions implemented at El Harissa and the project more broadly demonstrate the role of integrative design in reducing meat consumption in restaurant contexts. The project's

first phase highlighted many enablers and barriers to plant-rich dining at El Harissa. Co-selecting and co-producing the intervention strategies with my project partner led to valuable insights for El Harissa's practices and resulted in a more informed intervention design. The implemented carbon labeling, descriptive environmental messaging, and appealing menu language led to increased awareness and modest shifts in the selection of lower-carbon dishes. Below I describe the value of this work related to the wicked problem, El Harissa, and the DfSB subdiscipline.

Value to the Wicked Problem

Shifting diets to more sustainable patterns is certainly a wicked problem (Rittel and Webber 1973) and sits within the even larger, "super-wicked problem (Lazarus 2009)" of climate change. Even working within a microcosm of this problem, reducing meat consumption at El Harissa defies perfect resolution. We must reckon with the interdependencies of Ann Arbor's restaurant landscape and seasonality of ingredients, uncertainties with the rising cost of meat, fluctuating COVID-19 pandemic safety protocols, and tensions with customers' desires and dietary restrictions.

As such, this project did not set out to "solve" climate change or categorically eliminate meat consumption from restaurants. As "the process of solving [a] problem is identical with the process of understanding its nature (Rittel and Webber 1973)," my project partner and I engaged in this Co-Design process and implemented behavior change interventions to further understand the nature of reducing meat consumption in a restaurant context. Of course, we also intended to produce results that shift behavior in a positive direction while keeping the restaurant economically viable. We accomplished both these aims.

The customer interviews findings from Phase 1 support the meat consumption studies described in the contextual review. Many customers who identified as meat-eaters found that reducing consumption took a lower priority than taste, treating oneself, culinary traditions, and accommodating dietary restrictions, which aligns with research findings from Piazza et al. (2015), Sanchez-Sabate, Badilla-Briones, and Sabaté (2019), Biermann and Rau (2020). The finding of customers favoring dishes they would not make themselves calls back to Biermann and Rau's (2020) finding of consumers choosing to eat meat because it is prepared better than at home. Though it appears as a barrier, it could be construed as an opportunity for El Harissa or other restaurants to develop plant-rich dishes that have special ingredients or preparations.

The interview sessions with Yusef brought to light some of the barriers to encouraging plant-rich dining from the restaurant operator's perspective which has been largely missing from the literature. Though he is interested in developing new plant-rich dishes for his restaurant, time constraints, staffing limitations, and physically accommodating more dishes in their deli case were all deemed barriers to taking action. The desire to have an economically viable business is another tension point. While meat dishes account for about 20% of the menu, they are consistently top sellers, and eliminating them from El Harissa's options would significantly impact their revenue.

There is no test to record all of the consequences, positive or negative, of a solution (Rittel and Webber 1973), including the consequences of producing a solution. Nevertheless, at the very least, the intervention has appeared to cultivate awareness of the impacts of meat consumption and shift customer choices towards lower-carbon choices. The average carbon footprint per as-sold dish was 2% less in the implementation period compared to the prior two weeks. Staff also become more aware of the impacts of the dishes they serve. Engaging Yusef in

calculating the carbon footprint of his dishes heightened his awareness of the impacts of his menu and may change the way he approaches his offerings moving forward. Although these changes in awareness seem minor, they could lead to positive repercussions within El Harissa and other food environments.

During our first interview, Yusef described El Harissa as "an unusual business serving unusual cuisine in an unusual way." Though one may not find North African takeout in every American city—in fact, it's the only Tunisian restaurant in the state of Michigan (Perkins 2022)—the integrative design approach taken in this project can be used as a foundation to explore additional design interventions to encourage sustainable food choices in other out-of-home dining contexts. Out-of-home dining contexts, such as restaurants and university dining halls, are diverse when one considers the type of cuisine served, the type of meal, the price-point, the level of customer interaction with staff, and ordering modalities. These characteristics will likely dictate which intervention strategies are appropriate for a given context. However, Attwood et al. (2020) note that there is still not enough research to indicate whether certain interventions are more effective than others and urge the foodservice industry and research institutes to further assess the impacts of various interventions. As demonstrated through this project, design practitioners are equipped to integrate knowledge from various fields, investigate human behavior, and closely collaborate with stakeholders to iteratively develop design interventions to address the wicked problem of reducing meat consumption in restaurants.

One example of where this integrative approach would have been welcomed is in the behavior change research currently being conducted within the University of Michigan dining halls to support the university's carbon neutrality goals. The researchers are testing a series of interventions to reduce red meat consumption, with carbon labeling being one of those interventions. After advising me on this thesis, one of the researchers admitted that she wished that she and

her colleagues had taken a more holistic design approach that better encompassed students' and Michigan Dining stakeholders' views using Co-Design methods. This thesis expanded her perspective on how designers are not solely present to develop eye-catching logos and print materials, but are thoughtful researchers and collaborators who can greatly contribute to this space (Lesli Hoey, pers. comm.).

Value to El Harissa

Yusef's active engagement as Co-Designer throughout this project has built his capacity to integrate his family's values surrounding environmental sustainability into the operation of their business. Co-developing the *El Harissa Test Kitchen* generative research activity and customer interview questions led to increased knowledge about how his customers perceive plant-rich dishes and the multiple factors they consider when ordering a meal. Co-selecting the specific target behavior and intervention strategies together led us to focus our energies to where we could generate the most positive impacts for El Harissa while minimizing potential financial risk. Co-writing the taste-forward language for each dish led to Yusef adopting the intervention in his verbal descriptions and recommendations to customers. Co-calculating the carbon footprint of each dish led to an increase in Yusef's awareness of the climate change impacts of El Harissa's offerings.

Continued ownership and engagement with these design interventions, whether in this current form or in a future iteration, would be a powerful means for El Harissa to demonstrate its commitment to the triple bottom line, an entrepreneurial framework that seeks to add social and environmental value in addition to economic value (Elkington 2004, 3). This is evident in the implementation of the menu board and carbon labels in particular, which created a platform for Yusef and his staff to

initiate conversation with customers. Having a friendly face behind the deli case to provide additional context about the carbon labels may make learning this technical information less intimidating for customers. Additionally, these conversations provide an opportunity for customers to express their opinions about the labels, which were generally positive when the labels were understood, and confirm that customers appreciate El Harissa's commitment to reducing its carbon footprint.

Beyond the implemented interventions, this project has more broadly contributed to A²ZERO's action to Support Plant-Rich Diets by working with a business that already has more plant-rich options than the norm. The customer interviews uncovered customer experience concerns not described in this thesis that, if addressed, may improve El Harissa's business. Designing and installing the new menu materials created a more cohesive visual identity in the ordering area. Additionally, other behavior change strategies were explored that we could not implement in this project, such as developing dishes based on customers' concepts from the *El Harissa Test Kitchen*. El Harissa can implement these and other strategies as their business develops and grow a portfolio of sustainability efforts that can become a model for the Ann Arbor-area restaurant industry.

Contribution to Design for Sustainable Behaviors

This project demonstrates the application of DfSB in a real-world context, something that Lilley and Wilson (2017) admit that the growing subdiscipline is missing. More specifically, it demonstrates how its process can be applied to developing design interventions to reduce meat consumption, a behavior that has been underexplored by the design field (Clune and Lockton 2017). Discovering the similar struc-

ture between Lilley and Wilson's (2017) *Axis of Influence* and Wellesley, Happer, and Froggatt's (2015) categorization of meat consumption reduction strategies suggests that DfSB, combined with its process of understanding user behavior to identifying and implementing appropriate strategies, may be an effective approach for continued exploration in encouraging sustainable food choices.

I cannot claim that integrating Co-Design approaches into DfSB is more effective than not integrating them, as "every solution to a wicked problem is a 'one-shot operation' (Rittel and Webber 1973)" and replicating this exact project would be impossible. However, Yusef's involvement both as a research participant and as an active collaborator has proven to be incredibly useful in this project. During the Phase 1 observation sessions, Yusef would stop by and provide context about specific instances with customers. The *El Harissa Test Kitchen* was born out of Yusef's interest in learning about customers' ingredient preferences, and we worked together to curate a collection of ingredients that represented El Harissa's cuisine. Intervention strategies were selected together with Yusef with strong consideration for El Harissa's needs (i.e., a new menu board and deli cards) and balancing intervention effectiveness with potential customer reactions. Calculating the carbon footprints and writing enhanced descriptions were collaborative efforts that afforded a sense of ownership for Yusef in the design process and cultivated new skills that he can continue to apply at El Harissa. Finally, Yusef's experience "living with" the intervention materials during the implementation period, debriefing discussions, and analyzing changes in sales will help inform future iterations of the interventions. By example of this project, I argue that involving stakeholders beyond the end-user throughout the DfSB research and design process is necessary for developing effective interventions. In this case, Yusef, the design intervention stakeholder, contributed ideas, identified constraints, and challenged assumptions.

However, integrating Co-Design into DfSB did present some challenges. First, my original research plan outlined participation from El Harissa's staff during each phase of the DfSB design process to understand how they shape customer choices and contribute their perspectives in strategy selection, intervention design, and intervention implementation. However, staff participation only truly occured when I brought in intervention prototypes and discussed their experiences with the implemented intervention. Some of this limited participation can be attributed to external factors, such as staff being out sick due to COVID-19, but it can also be attributed to my desire to not be obtrusive to the business and disrupt a staff member's duties. Nevertheless, future DfSB work could explore research and Co-Design methods that are less time consuming than a one-on-one interview or prototyping session.

Second, integrating Co-Design in this project created tension with Lilley and Wilson's (2017) recommendation that premature behavior change should be avoided in the research and design phases leading up to the actual implementation of the intervention. While doing so may be ideal for documenting a pure, observable change in behavior, a restaurant is not a lab and meeting this ideal was infeasible. In Phase 1, it would have been disingenuous of me to not reveal to the customer interview participants that Yusef and I were going to use their data to inform design interventions. Of course, at the time we did not know which strategy we were going to implement, and I only explained the goals of the project in a general sense. However, it is possible that when those customers visited El Harissa months later with the new menu board installed, they could have realized that this was the intervention I was referring to and would then perhaps choose a plant-rich dish out of social desirability. In Phase 4, Yusef revealed that he had been using more taste-forward language in conversations with customers

and made an attempt to describe a new plant-rich dessert item for El Harissa's online menu. It's possible that it influenced customer selections prior to implementation, though we were not able to document this to any extent.

It can also be argued that each phase in itself are interventions that instigate a premature change. It is possible that an omnivore-identifying customer, after engaging in an hour-long interview and generative research activities, might consider trying out more of El Harissa's plant-rich offerings. The behavior change need not be confined to customers either. Yusef might not have appreciated the varying climate change impacts across El Harissa's offerings and could have been less willing to make changes to the menu in the future had I simply calculated the carbon footprints for each dish myself.

Limitations

El Harissa voluntarily elected to Co-Design and implement a series of behavior change interventions to encourage the selection of more sustainable food choices. The restaurant, founded by a former medical researcher and a former schoolteacher, provided a very specific context and cuisine for this inquiry, which calls into question the generalizability of the early results indicating that descriptive environmental messaging, carbon labeling, and appealing menu language are compelling design interventions to shift customer food choices in restaurant settings, and that Co-Design and DfSB are appropriate approaches to select and develop those strategies. Additional research is needed to validate whether the combination of these interventions and design methodologies can effectively translate to all restaurant or out-of home dining contexts.

The duration and timing of the intervention period challenges the validity of the research findings. The two-week data collection period overlapped with Ramadan, and Tunisia, the culinary origin of El Harissa's offerings, is a predominantly Muslim country. It is entirely possible that Ann Arbor-area Muslims observing Ramadan may have ordered differently for Iftar, the fast-breaking evening meal occuring at sunset, than had it been not Ramadan. However, in discussing this overlap with Yusef, he revealed that only a small number of El Harissa's customers are Muslim. Yusef also noted that the local public schools surrounding the restaurant had a much larger impact on the number of transactions occuring in this time, as many families travel during such a period. Furthermore, while the two-week data collection period indicates promise for the design interventions, it is not enough to determine if the short-term behavior change is durable over the long-term. At the time of writing, El Harissa intends to use the intervention menu board, deli display cards, and informational flyer in the restaurant beyond this thesis, which will allow us to assess any changes in sales over a longer period of time.

The COVID-19 pandemic presents additional considerations. Two years and two months into the pandemic, the U.S. restaurant industry and the safety of food service workers and customers are far from an ideal situation. Fractured masking behavior places servers at risk. Customers are uncertain about the safety of outdoor dining. Single-use plastic takeout containers delivered by underpaid drivers pile up in our landfills. Customers avoiding restaurants entirely risk the livelihood of owners and staff who may not have a social safety net (Canavan 2021). At the time of writing, El Harissa primarily relies on a takeout model and the return to indoor dining remains cautious.

This project may have taken a different shape in a world without COVID-19. Carryout, delivery, and disposable menus may be less prevalent. Perhaps more Ann Arbor-area restaurant owners, managers, and

staff may have had more capacity to participate. Within my partnership with El Harissa, there may have been more focus on the dine-in experience and how the role of dining with others influences food choices. However, the early months of COVID-19 ushered in a modest reduction in meat sales, attributed to fewer people dining out during lockdown periods. Consumer supermarket spending on meat products have not compensated for the loss in restaurant meat sales (Attwood and Hajat 2020). These short-term shifts can yield both health and environmental benefits, but only if they become longer-term habits. Customers' desire to treat oneself with a meat-centric dish when dining out (Biermann and Rau 2020), may come into stronger focus as more Americans feel comfortable returning to in-person dining. More research is required to develop design interventions that encourage and support these new, more sustainable food behaviors.

CONCLUSION & FUTURE WORK

This project developed specific and localized behavior change interventions to address the wicked problem of reducing meat consumption in restaurant contexts. These interventions, which modestly shifted customer food choices and increased customers' awareness of food's impact on climate change, developed in collaboration with El Harissa, an Ann Arbor, Michigan-based restaurant, and their customers. This thesis integrated Design for Sustainable Behaviors with Co-Design to investigate this problem space over five phases: understanding users in

context, specifying the target behavior, selecting appropriate strategies, producing strategies, and evaluating strategies.

Each phase brought forth discoveries that fed into the subsequent phases. The qualitative research methods in Phase 1 uncovered how customers interact with El Harissa's space and staff, customers' considerations when ordering, and the barriers and enablers to choosing plant-rich dishes. The *El Harissa Test Kitchen* offered additional insights about ingredient and preparation preferences, features of dishes they are attracted to, and experience with plant-rich dishes. The *Describe Your Dish* activity surfaced common words which were incorporated into the appealing menu language intervention. Additionally, interviews with Yusef in this phase brought forth El Harissa's constraints as a business and contributes to the literature on the restaurant industry's roles and perspectives on reducing meat consumption. Phases 2 and 3 opened up a world of possible design interventions that could be integrated across El Harissa's entire business. Yusef's contributions in this decision-making process helped bring El Harissa's constraints, as well as my constraints, into focus and is an example of how integrating stakeholder perspectives into these DfSB phases in particular are critical for developing informed design interventions. Producing the intervention materials alongside Yusef in Phase 4 resulted in him building more awareness of the impacts of his dishes and developing new ways to describe them. Though the implementation period was short, in Phase 5 we were able to see some preliminary changes in El Harissa customer choices. Findings from the observations, surveys, and ad-hoc interviews with staff and customers revealed some issues which will inform future iterations.

Future Work

With El Harissa

The evaluation data and findings represented in this thesis were limited to two weeks due to the time constraints of the academic calendar. However, El Harissa has volunteered to keep the menu board, deli cards, and informational flyer installed and continue collecting survey and sales data to assess the longer-term impacts of the interventions.

As one may recall, Design for Sustainable Behaviors is a cyclical process, as shown again in Figure 25 below. The findings described in this thesis, plus the data that El Harissa will continue to collect, will be incorporated into another iteration of the menu board and deli cards, including revisions to the carbon label and the enhanced dish descriptions.

Figure 24. *Share of dish sales by carbon label tier.*

As described in Phase 4 of the Methodology, the next iteration of the menu board will be a flexible system with magnetic tiles, addressing staff's concerns about communicating out-of-stock dishes with customers. Streamlining the dish descriptions will be explored, as some staff found the copy too long for customers to sift through. A single "planet-friendly" label may also be explored as an alternative to the traffic-light labeling system tested in this project. A single label may be more straightforward for customers to interpret and may induce less guilt because only the low-carbon dishes would be highlighted. The exploration of a single label is also inspired by the Ann Arbor City Council's recently passed resolution, *Resolution to Advance Sustainable Food Options at City Facilities and Events*, which aims to establish an "A²ZERO Preferred" labeling system for city-operated food-purchasing outlets (Nelson, Disch, and Hayner 2022). There may be some potential to align this project with those developments. The work in this next iteration aims to cultivate closer collaboration with El Harissa's staff, something that I was not able to accomplish during the initial phases of this project.

As I conclude this work, it will be important to ensure that El Harissa has the capacity to independently update the interventions we tested to maintain the longevity of the behavior change. The tools used to calculate the carbon labels of each dish, including the spreadsheets, the reference database, and a set of instructions, will be compiled into a guide that Yusef and his family can follow to calculate and assess the impacts of new dishes or modifications to existing dishes. A similar guide will be created for composing menu descriptions for new or modified dishes. Beyond El Harissa, this suite of tools could grow and become a framework for implementing interventions in various out-of-home dining contexts in the community to work toward the A²ZERO goal to support plant-rich diets.

There were many valid use cases and intervention pathways that El Harissa and I did not take in this project. Though they did not quite fit within the constraints of this project, they may become more feasible and attractive for El Harissa to undertake in the future. For example, the restaurant could develop a low GHG emissions catering menu with plant-rich options to align with the aforementioned Ann Arbor City Council resolution, which also recommends that City catering events work with vendors with low GHG emissions (Nelson, Disch, and Hayner 2022). All of the opportunities identified in the journey maps from Phases 2 and 3 will be compiled for El Harissa, who can take on these strategies themselves or collaborate with others in the community.

Beyond El Harissa

The shift to plant-rich diets is becoming increasingly important for the health of our planet and of ourselves, and restaurants will require technical support from various fields, particularly design, to make that happen (Yusef Houamed, pers. comm). In the brief reflection I have engaged in since ending data collection, I have developed the following considerations for future practitioners. These recommendations are takeaways that I intend to incorporate as I continue to work in this problem space:

- **Build a tailored case** for restaurant owners and managers who are hesitant to invest time, energy, and money into implementing one or more strategies. In the case made to El Harissa, I emphasized that these design interventions align with their values of sustainability and educating their community, could start small to minimize economic or reputational risk, and would not require financial investment on their part, as I had access to funds to support the research. However, recruiting another business may require other lines of reasoning.

- **Be patient** with seeking potential restaurant partners and take time to cultivate relationships. Get to know owners, managers, and staff and build trust before formally "kicking off" a project to design behavior change interventions.

- **Collaborate, don't impose these strategies.** Allow restaurant stakeholders and customers to be involved in ways that suit their interests (such as developing new dishes, developing marketing copy, or analyzing sales data).

- **Strengthen staff involvement** in strategy selection and production of implementation materials, as they will be primary stakeholders interacting with the design, alongside customers.

- **Iterate** upon the intervention materials by conducting feedback sessions with customers and stakeholders or small pilots to debug the design before a more extended implementation period.

- **Triangulate evaluation methods.** Restaurants are a dynamic setting in which to conduct applied research. However, evaluating the impacts of design interventions may be less straightforward compared to a lab setting, especially if one is simultaneously testing multiple interventions. If time allows, testing single interventions in phases may yield clearer data, but one may miss out on observing the interactions between interventions. In any case, employ multiple research methods (i.e., observation, surveys, interviews, sales analysis) that are tailored to the intervention and the restaurant setting. Though the findings of a specific restaurant may not be generalizable, the integrative nature of this approach can certainly permeate the industry to have a broader impact on what we put on our plates.

References

Allen, Mike. 2017. "Participant Observation." In *The SAGE Encyclopedia of Communication Research Methods*, 1188–90. Thousand Oaks, CA: SAGE Publications, Inc. https://doi.org/10.4135/9781483381411.n412.

Anderson, Brett, and Jenny Gross. 2021. "The New Menu at Eleven Madison Park Will Be Meatless." *The New York Times*, May 3, 2021, sec. Food. https://www.nytimes.com/2021/05/03/dining/eleven-madison-park-vegan-menu.html.

Attwood, Sophie, S. J. Chesworth, and B. L. Parkin. 2020. "Menu Engineering to Encourage Sustainable Food Choices When Dining out: An Online Trial of Priced-Based Decoys." *Appetite* 149 (June): 104601. https://doi.org/10.1016/j.appet.2020.104601.

Attwood, Sophie, and Cother Hajat. 2020. "How Will the COVID-19 Pandemic Shape the Future of Meat Consumption?" *Public Health Nutrition* 23 (17): 3116–20. https://doi.org/10.1017/S136898002000316X.

Attwood, Sophie, Paula Voorheis, Cecelia Mercer, Karen Davies, and Daniel Vennard. 2020. *Playbook for Guiding Diners Toward Plant-Rich Dishes in Food Service*. ISBN 978-1-56973-971-6. Washington, DC: World Resources Institute. https://www.wri.org/research/playbook-guiding-diners-toward-plant-rich-dishes-food-service.

Babakhani, Nazila, Andy Lee, and Sara Dolnicar. 2020. "Carbon Labels on Restaurant Menus: Do People Pay Attention to Them?" *Journal of Sustainable Tourism* 28 (1): 51–68. https://doi.org/10.1080/09669582.2019.1670187.

Bacon, Linda, and Dario Krpan. 2018. "(Not) Eating for the Environment: The Impact of Restaurant Menu Design on Vegetarian Food Choice." *Appetite* 125 (June): 190–200. https://doi.org/10.1016/j.appet.2018.02.006.

Bajzelj, Bojana, Keith S. Richards, Julian M. Allwood, Pete Smith, John S. Dennis, Elizabeth Curmi, and Christopher A. Gilligan. 2014. "Importance of Food-Demand Management for Climate Mitigation." *Nature Climate Change* 4 (10): 924–29. http://dx.doi.org.proxy.lib.umich.edu/10.1038/nclimate2353.

Bell, Kenton. 2016. "Agency Definition." Open Education Sociology Dictionary. June 3, 2016. https://sociologydictionary.org/agency/.

Bhamra, Tracy, Debra Lilley, and Tang Tang. 2011. "Design for Sustainable Behaviour: Using Products to Change Consumer Behaviour." *The Design Journal* 14 (4): 427–45. https://doi.org/10.2752/175630611X13091688930453.

Biermann, Gesa, and Henrike Rau. 2020. "The Meaning of Meat: (Un)Sustainable Eating Practices at Home and out of Home." *Appetite* 153 (October): 104730. https://doi.org/10.1016/j.appet.2020.104730.

Bilow, Rochelle. 2015. "Plant-Based. Meat-Minimal. Vegetable-Forward. 16 Recipes That Are Kinda Sorta Not Really Vegetarian." *Bon Appétit*. October 7, 2015. https://www.bonappetit.com/recipes/slideshow/plant-based-meat-minimal.

Blondin, Stacy, Sophie Attwood, Daniel Vennard, and Vanessa Mayneris. 2022. "Environmental Messages Promote Plant-Based Food Choices: An Online Restaurant Menu Study." *World Resources Institute*. https://doi.org/10.46830/wriwp.20.00137.

Blount, Chuck. 2022. "Why Don't Barbecue Restaurants Serve Better Vegetarian Dishes?" *San Antonio Express-News (TX)*. https://www.expressnews.com/food/chucks-food-shack/article/barbecue-restaurants-vegetarian-dishes-16785195.php.

Boer, Joop de, Annick de Witt, and Harry Aiking. 2016. "Help the Climate, Change Your Diet: A Cross-Sectional Study on How to Involve Consumers in a Transition to a Low-Carbon Society." *Appetite* 98 (March): 19–27. https://doi.org/10.1016/j.appet.2015.12.001.

Boks, Casper, and Johannes Zachrisson Daae. 2017. "Design for Sustainable Use Using Principles of Behaviour Change." In *Routledge Handbook of Sustainable Product Design*, by Jonathan Chapman, 1st ed., 316–34. New York: Routledge. https://doi.org/10.4324/9781315693309-26.

Bowie, Matthew J., Timo Dietrich, Phillip Cassey, and Diogo Veríssimo. 2020. "Co-Designing Behavior Change Interventions to Conserve Biodiversity." *Conservation Science and Practice* 2 (11): e278. https://doi.org/10.1111/csp2.278.

Broekema, Roline, Marcelo Tyszler, Pieter van 't Veer, Frans J. Kok, Agnès Martin, Anne Lluch, and Hans T. J. Blonk. 2020. "Future-Proof and Sustainable Healthy Diets Based on Current Eating Patterns in the Netherlands." *The American Journal of Clinical Nutrition* 112 (5): 1338–47. https://doi.org/10.1093/ajcn/nqaa217.

Brunner, Florentine, Verena Kurz, David Bryngelsson, and Fredrik Hedenus. 2018. "Carbon Label at a University Restaurant – Label Implementation and Evaluation." *Ecological Economics* 146 (C): 658–67.

Bryant, Antony, and Kathy Charmaz. 2007. *The SAGE Handbook of Grounded Theory*. Thousand Oaks, CA: SAGE.

Buis, Alan. 2019. "A Degree of Concern: Why Global Temperatures Matter." NASA | Climate Change: Vital Signs of the Planet. June 19, 2019. https://climate.nasa.gov/news/2865/a-degree-of-concern-why-global-temperatures-matter.

Cai, Chris He, Anni Ding, and Tiffany Shin Legendre. 2021. "Exploring Persuasive Sales Techniques to Improve Customer Acceptance of Sustainable but Unfamiliar Menu in Restaurants." *International Journal of Contemporary Hospitality Management* 33 (10): 3093–3114. https://doi.org/10.1108/IJCHM-08-2020-0924.

Campbell-Arvai, Victoria. 2015. "Food-Related Environmental Beliefs and Behaviours among University Undergraduates: A Mixed-Methods Study." *International Journal of Sustainability in Higher Education* 16 (3): 279–95. https://doi.org/10.1108/IJSHE-06-2013-0071.

Campbell-Arvai, Victoria, Joseph Arvai, and Linda Kalof. 2014. "Motivating Sustainable Food Choices: The Role of Nudges, Value Orientation, and Information Provision." *Environment and Behavior* 46 (4): 453–75. https://doi.org/10.1177/0013916512469099.

Canavan, Hillary Dixler. 2021. "The Responsibility of Saving Restaurants Should Never Have Been Ours." Eater. March 15, 2021. https://www.eater.com/22321575/covid-19-one-year-later-government-response-restaurants-workers-diners.

Charmaz, Kathy. 2014. *Constructing Grounded Theory*. 2nd ed. Thousand Oaks, CA: SAGE Publications, Inc.

City of Ann Arbor. 2020. "A2ZERO Climate Action Plan 3.0: Ann Arbor's Living Carbon Neutrality Plan." City of Ann Arbor. https://www.a2gov.org/departments/sustainability/Documents/A2Zero%20Climate%20Action%20Plan%20_3.0.pdf.

Clune, Stephen, and Dan Lockton. 2017. "Design for Behavioural Change and Sustainability." In *Design for Behaviour Change*, edited by Kristina Niedderer, Stephen Clune, and Geke Ludden, 1st ed., 166–83. New York: Routledge. https://doi.org/10.4324/9781315576602-15.

Çoker, Elif Naz, Rachel Pechey, Kerstin Frie, Susan A. Jebb, Cristina Stewart, Suzanne Higgs, and Brian Cook. 2022. "A Dynamic Social Norm Messaging Intervention to Reduce Meat Consumption: A Randomized Cross-over Trial in Retail Store Restaurants." *Appetite* 169 (February): 105824. https://doi.org/10.1016/j.appet.2021.105824.

Collier, Elizabeth S., Lisa-Maria Oberrauter, Anne Normann, Cecilia Norman, Marlene Svensson, Jun Niimi, and Penny Bergman. 2021. "Identifying Barriers to Decreasing Meat Consumption and Increasing Acceptance of Meat Substitutes among Swedish Consumers." *Appetite* 167 (December): 105643. https://doi.org/10.1016/j.appet.2021.105643.

Cross, Nigel. 2006. *Designerly Ways of Knowing*. London: Springer.

Dagevos, Hans. 2021. "Finding Flexitarians: Current Studies on Meat Eaters and Meat Reducers." *Trends in Food Science & Technology* 114 (August): 530–39. https://doi.org/10.1016/j.tifs.2021.06.021.

Daniel, Johnnie. 2012. *Sampling Essentials: Practical Guidelines for Making Sampling Choices*. Thousand Oaks, CA: SAGE Publications, Inc. https://doi.org/10.4135/9781452272047.

Denchak, Melissa, and Jeff Turrentine. 2021. "Global Climate Change: What You Need to Know." NRDC. September 1, 2021. https://www.nrdc.org/stories/global-climate-change-what-you-need-know.

Doherty, Thomas J., and Susan Clayton. 2011. "The Psychological Impacts of Global Climate Change." *American Psychologist*, Psychology and Global Climate Change, 66 (4): 265–76. https://doi.org/10.1037/a0023141.

Drisko, James W., and Tina Maschi. 2016. *Content Analysis*. Oxford University Press.

Durkee, John. 2006. "2 - US and Global Environmental Regulations." In *Management of Industrial Cleaning Technology and Processes*, edited by John Durkee, 43–98. Oxford: Elsevier Science. https://doi.org/10.1016/B978-008044888-6/50016-8.

Eker, Sibel, Gerhard Reese, and Michael Obersteiner. 2019. "Modelling the Drivers of a Widespread Shift to Sustainable Diets." *Nature Sustainability* 2 (8): 725–35. https://doi.org/10.1038/s41893-019-0331-1.

Elkington, John. 2004. "Enter the Triple Bottom Line." In *The Triple Bottom Line, Does It All Add up? Assessing the Sustainability of Business and CSR*, edited by Adrian Henriques and Julie Richardson. London ; Sterling, VA: Earthscan.

Filimonau, Viachaslau, Christian Lemmer, David Marshall, and Gisel Bejjani. 2017. "Restaurant Menu Re-Design as a Facilitator of More Responsible Consumer Choice: An Exploratory and Preliminary Study." *Journal of Hospitality and Tourism Management* 33 (December): 73–81. https://doi.org/10.1016/j.jhtm.2017.09.005.

Franko, Emily. 2017. "You Are Who You Eat With: Barriers to Adopting Animal-Free Diets." Masters Thesis, Boston, MA: Boston College. http://hdl.handle.net/2345/bc-ir:107377.

Friis, Rasmus, Laurits Rohden Skov, Annemarie Olsen, Katherine Marie Appleton, Laure Saulais, Caterina Dinnella, Heather Hartwell, et al. 2017. "Comparison of Three Nudge Interventions (Priming, Default Option, and Perceived Variety) to Promote Vegetable Consumption in a Self-Service Buffet Setting." *PLOS ONE* 12 (5): e0176028. https://doi.org/10.1371/journal.pone.0176028.

Fuster, Melissa, Margaret A. Handley, Tamara Alam, Lee Ann Fullington, Brian Elbel, Krishnendu Ray, and Terry T.-K. Huang. 2021. "Facilitating Healthier Eating at Restaurants: A Multidisciplinary Scoping Review Comparing Strategies, Barriers, Motivators, and Outcomes by Restaurant Type and Initiator." *International Journal of Environmental Research and Public Health* 18 (4): 1479. https://doi.org/10.3390/ijerph18041479.

Gallimore, Tara Elizabeth. 2015. "Understanding the Reasons for and Barriers to Becoming Vegetarian in Prospective Vegetarians and Vegans: A Qualitative Phenomenological Exploration." Masters Thesis, Montreal: McGill University.

Garnett, Emma E., Andrew Balmford, Chris Sandbrook, Mark A. Pilling, and Theresa M. Marteau. 2019. "Impact of Increasing Vegetarian Availability on Meal Selection and Sales in Cafeterias." *Proceedings of the National Academy of Sciences* 116 (42): 20923–29. https://doi.org/10.1073/pnas.1907207116.

Garnett, Emma E., Theresa M. Marteau, Chris Sandbrook, Mark A. Pilling, and Andrew Balmford. 2020. "Order of Meals at the Counter and Distance between Options Affect Student Cafeteria Vegetarian Sales." *Nature Food* 1 (8): 485–88. https://doi.org/10.1038/s43016-020-0132-8.

Gerber, P. J., H. Steinfeld, B. Henderson, A. Mottet, C. Opio, J. Dijkman, A. Falcucci, G. Tempio, and Animal Production and Health Division. 2013. T*ackling Climate Change through Livestock: A Global Assessment of Emissions and Mitigation Opportunities*. Rome, Italy: FAO. http://www.fao.org/publications/card/en/c/030a41a8-3e10-57d1-ae0c-86680a69ceea/.

Gibson, James J. 1977. *The Ecological Approach to Visual Perception: Classic Edition*. London: Taylor & Francis Group. http://ebookcentral.proquest.com/lib/umichigan/detail.action?docID=1864844.

Given, Lisa. 2008. "Semi-Structured Interview." In *The SAGE Encyclopedia of Qualitative Research Methods*. Thousand Oaks, CA: SAGE Publications, Inc. https://doi.org/10.4135/9781412963909.n420.

Glegg, Stephanie M. N. 2019. "Facilitating Interviews in Qualitative Research With Visual Tools: A Typology." *Qualitative Health Research* 29 (2): 301–10. https://doi.org/10.1177/1049732318786485.

Hanratty, Marcus. 2015. "Design for Sustainable Behaviour: A Conceptual Model and Intervention Selection Model for Changing Behaviour through Design." Ph.D. Dissertation, Loughborough, UK: Loughborough University. https://ethos.bl.uk/OrderDetails.do?uin=uk.bl.ethos.674598

Hansen, Pelle G, Mathilde Schilling, and Mia S Malthesen. 2019. "Nudging Healthy and Sustainable Food Choices: Three Randomized Controlled Field Experiments Using a Vegetarian Lunch-Default as a Normative Signal." *Journal of Public Health* 43 (2): 392–97. https://doi.org/10.1093/pubmed/fdz154.

Hartmann, Christina, and Michael Siegrist. 2017. "Consumer Perception and Behaviour Regarding Sustainable Protein Consumption: A Systematic Review." *Trends in Food Science & Technology* 61 (March): 11–25. https://doi.org/10.1016/j.tifs.2016.12.006.

Hausfather, Zeke. 2020. "Analysis: When Might the World Exceed 1.5C and 2C of Global Warming?" Carbon Brief. December 4, 2020. https://www.carbonbrief.org/analysis-when-might-the-world-exceed-1-5c-and-2c-of-global-warming.

Hazas, Mike, A. J. Bernheim Brush, and James Scott. 2012. "Sustainability Does Not Begin with the Individual." *Interactions* 19 (5): 14–17. https://doi.org/10.1145/2334184.2334189.

Hedenus, Fredrik, Stefan Wirsenius, and Daniel J. A. Johansson. 2014. "The Importance of Reduced Meat and Dairy Consumption for Meeting Stringent Climate Change Targets." *Climatic Change* 124 (1): 79–91. https://doi.org/10.1007/s10584-014-1104-5.

Heller, Martin C., Gregory A. Keoleian, and Walter C. Willett. 2013. "Toward a Life Cycle-Based, Diet-Level Framework for Food Environmental Impact and Nutritional Quality Assessment: A Critical Review." *Environmental Science & Technology* 47 (22): 12632–47. https://doi.org/10.1021/es4025113.

Heller, Martin C., Gregory Keoleian, and Diego Rose. 2020. "Implications of Future US Diet Scenarios on Greenhouse Gas Emissions." CSS20-01. Ann Arbor, MI: Center for Sustainable Systems, University of Michigan. https://css.umich.edu/sites/default/files/publication/CSS20-01.pdf.

Heller, Martin C., Amelia Willits-Smith, Robert Meyer, Gregory A. Keoleian, and Donald Rose. 2018. "Greenhouse Gas Emissions and Energy Use Associated with Production of Individual Self-Selected US Diets." *Environmental Research Letters* 13 (4): 044004. https://doi.org/10.1088/1748-9326/aab0ac.

Hoolohan, C., M. Berners-Lee, J. McKinstry-West, and C. N. Hewitt. 2013. "Mitigating the Greenhouse Gas Emissions Embodied in Food through Realistic Consumer Choices." *Energy Policy* 63 (December): 1065–74. https://doi.org/10.1016/j.enpol.2013.09.046.

Horgan, G. W., A. Scalco, T. Craig, S. Whybrow, and J. I. Macdiarmid. 2019. "Social, Temporal and Situational Influences on Meat Consumption in the UK Population." *Appetite* 138 (July): 1–9. https://doi.org/10.1016/j.appet.2019.03.007.

Houck, Brenna. 2019. "Why Conservatives Won't Stop Talking About Burgers." Eater. March 1, 2019. https://www.eater.com/2019/3/1/18246220/aoc-green-deal-burgers-backlash-creepshot.

IPCC. 2018. "Special Report: Global Warming of 1.5oC Summary for Policymakers." In *Global Warming of 1.5°C. An IPCC Special Report on the Impacts of Global Warming of 1.5°C above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty. Intergovernmental Panel on Climate Change.* https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_SPM_version_report_LR.pdf.

Jelsma, Jaap, and Marjolijn Knot. 2002. "Designing Environmentally Efficient Services; a 'Script' Approach." *The Journal of Sustainable Product Design* 2 (3): 119–30. https://doi.org/10.1023/B:JSPD.0000031031.20974.1b.

Jentsch, Anke, and Carl Beierkuhnlein. 2008. "Research Frontiers in Climate Change: Effects of Extreme Meteorological Events on Ecosystems." *Comptes Rendus Geoscience, Ecosystèmes et événements climatiques extrêmes,* 340 (9): 621–28. https://doi.org/10.1016/j.crte.2008.07.002.

Just Salad. 2022. "Make Carbon Count: A Guide to Our Carbon Label, a Nutrition Label for the Earth." Just Salad. March 24, 2022. https://justsalad.com.

Kalbach, James. 2016. *Mapping Experiences: A Guide to Creating Value through Journeys, Blueprints, and Diagrams.* First Edition. Sebastopol, CA: O'Reilly. https://learning.oreilly.com/library/view/mapping-experiences/9781491923528/maex_ch10.xhtml.

Kleinsmann, Maaike, and Rianne Valkenburg. 2008. "Barriers and Enablers for Creating Shared Understanding in Co-Design Projects." *Design Studies* 29 (4): 369–86. https://doi.org/10.1016/j.destud.2008.03.003.

Kolko, Jon. 2010. "Abductive Thinking and Sensemaking: The Drivers of Design Synthesis." *Design Issues* 26 (1): 15–28. https://doi.org/10.1162/desi.2010.26.1.15.

———. 2012. *Wicked Problems: Problems Worth Solving - A Handbook and Call to Action.* Edited by Ronnie Lipton. Austin, TX: Austin Center for Design.

Krpan, Dario, and Nanne Houtsma. 2020. "To Veg or Not to Veg? The Impact of Framing on Vegetarian Food Choice." *Journal of Environmental Psychology* 67 (February): 101391. https://doi.org/10.1016/j.jenvp.2020.101391.

Kunz, Sonja, Simona Haasova, Jannik Rieß, and Arnd Florack. 2020. "Beyond Healthiness: The Impact of Traffic Light Labels on Taste Expectations and Purchase Intentions." *Foods* 9 (2): 134. https://doi.org/10.3390/foods9020134.

Lazarus, Richard J. 2009. "Super Wicked Problems and Climate Change: Restraining the Present to Liberate the Future." *Cornell Law Review* 94 (5): 83.

Lea, Emma, D. Crawford, and A. Worsley. 2006. "Public Views of the Benefits and Barriers to the Consumption of a Plant-Based Diet." *European Journal of Clinical Nutrition* 60 (7): 828–37. https://doi.org/10.1038/sj.ejcn.1602387.

Lea, Emma, and Anthony Worsley. 2008. "Australian Consumers' Food-Related Environmental Beliefs and Behaviours." *Appetite* 50 (2): 207–14. https://doi.org/10.1016/j.appet.2005.07.012.

Lieberman, Bruce. 2021. "1.5 or 2 Degrees Celsius of Additional Global Warming: Does It Make a Difference?" Yale Climate Connections. August 4, 2021. http://yaleclimate-connections.org/2021/08/1-5-or-2-degrees-celsius-of-additional-global-warming-does-it-make-a-difference/.

Lilley, Debra. 2007. "Designing for Behavioural Change: Reducing the Social Impacts of Product Use through Design." Ph.D. Dissertation, Loughborough, UK: Loughborough University. https://repository.lboro.ac.uk/articles/thesis/Designing_for_behavioural_change_reducing_the_social_impacts_of_product_use_through_design/9355055/1.

———. 2009. "Design for Sustainable Behaviour: Strategies and Perceptions." *Design Studies* 30 (6): 704–20. https://doi.org/10.1016/j.destud.2009.05.001.

Lilley, Debra, and Garrath Wilson. 2013. "Integrating Ethics into Design for Sustainable Behaviour." *Journal of Design Research* 11 (January): 278–99. https://doi.org/10.1504/JDR.2013.056593.

Lilley, Debra, Garrath Wilson, Tracy Bhamra, Marcus Hanratty, and Tang Tang. 2018. "Design Interventions for Sustainable Behavior." In *Design for Behavior Change: Theories and Practices of Designing for Change*, edited by Kristina Niedderer, Stephen Clune, and Geke Ludden. Abingdon, UK: Routledge.

Lilley, Debra, and Garrath T Wilson. 2017. "Design for Sustainable Behavior." In *Routledge Handbook of Sustainable Product Design*, edited by Johnathan Chapman, 127–44. Abingdon, UK: Routledge.

Lockton, Dan, ed. 2019. *Climate Pathways: Projects from the Imaginaries Lab*. Pittsburgh, PA & Dawlish, UK: Imaginaries Lab. http://imaginari.es/climate.pdf.

Lockton, Dan, Rebecca Cain, David Harrison, Sebastiano Giudice, Luke Nicholson, and Paul Jennings. 2011. "Behaviour Change at Work: Empowering Energy Efficiency in the Workplace through User-Centred Design." In Washington, DC. https://escholarship.org/uc/item/6ww5h5jm.

Macdiarmid, Jennie I., Flora Douglas, and Jonina Campbell. 2016. "Eating like There's No Tomorrow: Public Awareness of the Environmental Impact of Food and Reluctance to Eat Less Meat as Part of a Sustainable Diet." *Appetite* 96 (January): 487–93. https://doi.org/10.1016/j.appet.2015.10.011.

Manzini, Ezio. 2007. "Design Research for Sustainable Social Innovation." In *Design Research Now: Essays and Selected Projects*, edited by Ralf Michel, 233–45. Basel: Birkhäuser. https://doi.org/10.1007/978-3-7643-8472-2_14.

Martin, Bella, and Bruce Hanington. 2012. *Universal Methods of Design: 100 Ways to Research Complex Problems, Develop Innovative Ideas, and Design Effective Solutions*. Beverly, MA: Rockport Publishers.

Mbow, C., C. Rosenzweig, L.G. Barioni, T.G. Benton, M. Herrero, M. Krishnapillai, E. Liwenga, et al. 2019. "Food Security." In *Climate Change and Land: An IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems*, 114. Intergovernmental Panel on Climate Change. https://www.ipcc.ch/site/assets/uploads/sites/4/2021/02/08_Chapter-5_3.pdf.

McManus, Katherine. 2020. "What Is a Plant-Based Diet and Why Should You Try It?" Harvard Health. August 31, 2020. https://www.health.harvard.edu/blog/what-is-a-plant-based-diet-and-why-should-you-try-it-2018092614760.

Meatless Monday. n.d. "Meatless Monday for Foodservice." The Monday Campaigns. Accessed April 16, 2022. https://www.mondaycampaigns.org/meatless-monday/foodservice.

Merriam, Sharan B., and Elizabeth J. Tisdell. 2015. *Qualitative Research: A Guide to Design and Implementation*. Newark, NJ: John Wiley & Sons, Inc. http://ebookcentral.proquest.com/lib/umichigan/detail.action?docID=2089475.

Mitchell, Val, Tracy Ross, Andrew May, Ruth Sims, and Christopher Parker. 2016. "Empirical Investigation of the Impact of Using Co-Design Methods When Generating Proposals for Sustainable Travel Solutions." *CoDesign* 12 (4): 205–20. https://doi.org/10.1080/15710882.2015.1091894.

Moss, Michael. 2013. *Salt, Sugar, Fat: How the Food Giants Hooked Us*. 1st ed. New York: Random House.

National Restaurant Association. 2022. "State of the Restaurant Industry 2022 Executive Report." National Restaurant Association. https://restaurant.org/nra/media/research/reports/2022/soi2022-summary.pdf.

Nelson, Elizabeth, Lisa Disch, and Jeff Hayner. 2022. *Resolution to Advance Sustainable Food Options at City Facilities and Events*. 22-0501. https://a2gov.legistar.com/ViewReport.ashx?M=R&N=Text&GID=55&ID=4751371&GUID=0F0229E8-9A35-4694-A7DA-7B0A951FF204&Title=Legislation+Text.

Norman, Donald A. 2002. *The Design of Everyday Things*. New York: Basic Books.

Norman, Donald A., and Pieter Jan Stappers. 2015. "DesignX: Complex Sociotechnical Systems." *She Ji: The Journal of Design, Economics, and Innovation* 1 (2): 83–106. https://doi.org/10.1016/j.sheji.2016.01.002.

Office of Sustainability and Innovations. 2020. "History." City of Ann Arbor. 2020. https://www.a2gov.org:443/departments/sustainability/Carbon-Neutrality/Pages/A2ZERO-History.aspx.

O'Keefe, Laura, Carly McLachlan, Clair Gough, Sarah Mander, and Alice Bows-Larkin. 2016. "Consumer Responses to a Future UK Food System." *British Food Journal* 118 (2): 412–28. https://doi.org/10.1108/BFJ-01-2015-0047.

Osman, Magda, and Katie Thornton. 2019. "Traffic Light Labelling of Meals to Promote Sustainable Consumption and Healthy Eating." *Appetite* 138 (July): 60–71. https://doi.org/10.1016/j.appet.2019.03.015.

Ostfeld, Robert J. 2017. "Definition of a Plant-Based Diet and Overview of This Special Issue." *Journal of Geriatric Cardiology* : JGC 14 (5): 315. https://doi.org/10.11909/j.issn.1671-5411.2017.05.008.

Otto, Ilona M., Diana Reckien, Christopher P. O. Reyer, Rachel Marcus, Virginie Le Masson, Lindsey Jones, Andrew Norton, and Olivia Serdeczny. 2017. "Social Vulnerability to Climate Change: A Review of Concepts and Evidence." *Regional Environmental Change* 17 (6): 1651–62. https://doi.org/10.1007/s10113-017-1105-9.

Panera Bread. 2022. "Cool Food Meals at Panera Bread." https://www.panerabread.com/content/dam/panerabread/integrated-web-content/documents/panera-cool-foods-meal-menu-items.pdf.

Parkin, B. L., and S. Attwood. 2022. "Menu Design Approaches to Promote Sustainable Vegetarian Food Choices When Dining Out." *Journal of Environmental Psychology* 79 (February): 101721. https://doi.org/10.1016/j.jenvp.2021.101721.

Perkins, Tom. 2022. "Michigan's Only Tunisian Restaurant, El Harissa, Thrives in Ann Arbor." Detroit Metro Times. January 22, 2022. https://www.metrotimes.com/food-drink/michigans-only-tunisian-restaurant-el-harissa-thrives-in-ann-arbor-23655789.

Philips, Rhiannon. 2019. "What Is the Cost of Going Vegan?" December 13, 2019. https://www.nerdwallet.com/uk/personal-finance/cost-of-going-vegan/.

Piazza, Jared, Matthew B. Ruby, Steve Loughnan, Mischel Luong, Juliana Kulik, Hanne M. Watkins, and Mirra Seigerman. 2015. "Rationalizing Meat Consumption. The 4Ns." *Appetite* 91 (August): 114–28. https://doi.org/10.1016/j.appet.2015.04.011.

Pohjolainen, Pasi, Markus Vinnari, and Pekka Jokinen. 2015. "Consumers' Perceived Barriers to Following a Plant-Based Diet." *British Food Journal* 117 (3): 1150–67. https://doi.org/10.1108/BFJ-09-2013-0252.

Poore, J., and T. Nemecek. 2018. "Reducing Food's Environmental Impacts through Producers and Consumers." *Science* 360 (6392): 987–92. https://doi.org/10.1126/science.aaq0216.

Reinders, Machiel J., Lilou van Lieshout, Gerda K. Pot, Nicole Neufingerl, Eva van den Broek, Marieke Battjes-Fries, and Joris Heijnen. 2020. "Portioning Meat and Vegetables in Four Different out of Home Settings: A Win-Win for Guests, Chefs and the Planet." *Appetite* 147 (April): 104539. https://doi.org/10.1016/j.appet.2019.104539.

Ritchie, Hannah, and Max Roser. 2020. "Environmental Impacts of Food Production." Our World in Data. January 15, 2020. https://ourworldindata.org/environmental-impacts-of-food.

Rittel, Horst, and Melvin Webber. 1973. "Dilemmas in a General Theory of Planning." *Policy Sciences* 4 (2): 16.

Rojas-Downing, M. Melissa, A. Pouyan Nejadhashemi, Timothy Harrigan, and Sean A. Woznicki. 2017. "Climate Change and Livestock: Impacts, Adaptation, and Mitigation." *Climate Risk Management* 16 (January): 145–63. https://doi.org/10.1016/j.crm.2017.02.001.

Rubin, Herbert, and Irene Rubin. 2012. *Qualitative Interviewing: The Art of Hearing Data*. 2nd ed. Thousand Oaks, CA: SAGE Publications, Inc. https://doi.org/10.4135/9781452226651.

Saldaña, Jonny. 2021. *The Coding Manual for Qualitative Researchers*. 4th ed. Thousand Oaks, CA: SAGE Publications, Inc.

Sanchez-Sabate, Ruben, Yasna Badilla-Briones, and Joan Sabaté. 2019. "Understanding Attitudes towards Reducing Meat Consumption for Environmental Reasons. A Qualitative Synthesis Review." *Sustainability* 11 (22): 6295. https://doi.org/10.3390/su11226295.

Sanchez-Sabate, Ruben, and Joan Sabaté. 2019. "Consumer Attitudes Towards Environmental Concerns of Meat Consumption: A Systematic Review." *International Journal of Environmental Research and Public Health* 16 (7): 1220. https://doi.org/10.3390/ijerph16071220.

Sanders, Elizabeth B.-N., Eva Brandt, and Thomas Binder. 2010. "A Framework for Organizing the Tools and Techniques of Participatory Design." In *Proceedings of the 11th Biennial Participatory Design Conference*, 195–98. PDC '10. New York, NY, USA: Association for Computing Machinery. https://doi.org/10.1145/1900441.1900476.

Sanders, Elizabeth B.-N., and Pieter Jan Stappers. 2008. "Co-Creation and the New Landscapes of Design." *CoDesign* 4 (1): 5–18. https://doi.org/10.1080/15710880701875068.

———. 2012. *Convivial Toolbox: Generative Research for the Front End of Design*. BIS.

———. 2014. "Probes, Toolkits and Prototypes: Three Approaches to Making in Codesigning." *CoDesign* 10 (1): 5–14. https://doi.org/10.1080/15710882.2014.888183.

Shehabi, Arman, Ben Walker, and Eric Masanet. 2014. "The Energy and Greenhouse-Gas Implications of Internet Video Streaming in the United States." *Environmental Research Letters* 9 (5): 054007. https://doi.org/10.1088/1748-9326/9/5/054007.

Siegrist, Michael, Vivianne H. M. Visschers, and Christina Hartmann. 2015. "Factors Influencing Changes in Sustainability Perception of Various Food Behaviors: Results of a Longitudinal Study." *Food Quality and Preference* 46 (December): 33–39. https://doi.org/10.1016/j.foodqual.2015.07.006.

Simon, Herbert Alexander. 1996. *The Sciences of the Artificial*. Third edition. Cambridge, MA: MIT Press.

Smith, Trevor J. 2019. "Corn, Cows, and Climate Change: How Federal Agricultural Subsidies Enable Factory Farming and Exacerbate U.S. Greenhouse Gas Emissions." *Washington Journal of Environmental Law & Policy* 9 (1): 31.

Sörqvist, Patrik, Andreas Haga, Linda Langeborg, Mattias Holmgren, Maria Wallinder, Anatole Nöstl, Paul B. Seager, and John E. Marsh. 2015. "The Green Halo: Mechanisms and Limits of the Eco-Label Effect." *Food Quality and Preference* 43 (July): 1–9. https://doi.org/10.1016/j.foodqual.2015.02.001.

Sparkman, Gregg, Elizabeth Weitz, Thomas N. Robinson, Neil Malhotra, and Gregory M. Walton. 2020. "Developing a Scalable Dynamic Norm Menu-Based Intervention to Reduce Meat Consumption." *Sustainability* 12 (6): 2453. https://doi.org/10.3390/su12062453.

Spencer, Molly, Amalie Kurzer, Cesar Cienfuegos, and Jean-Xavier Guinard. 2018. "Student Consumer Acceptance of Plant-Forward Burrito Bowls in Which Two-Thirds of the Meat Has Been Replaced with Legumes and Vegetables: The Flexitarian FlipTM in University Dining Venues." *Appetite* 131 (December): 14–27. https://doi.org/10.1016/j.appet.2018.08.030.

Springmann, Marco, Michael Clark, Daniel Mason-D'Croz, Keith Wiebe, Benjamin Leon Bodirsky, Luis Lassaletta, Wim de Vries, et al. 2018. "Options for Keeping the Food System within Environmental Limits." *Nature* 562 (7728): 519-525,525A-525Q. http://dx.doi.org.proxy.lib.umich.edu/10.1038/s41586-018-0594-0.

Stickdorn, Marc, and Jakob Schneider. 2011. *This Is Service Design Thinking*. Hoboken, NJ: John Wiley & Sons, Inc.

Tang, Tang. 2010. "Towards Sustainable Use: Design Behaviour Intervention to Reduce Household Environment Impact." Ph.D. Dissertation, Loughborough, UK: Loughborough University. https://repository.lboro.ac.uk/articles/thesis/Towards_sustainable_use_design_behaviour_intervention_to_reduce_household_environment_impact/9355334/1/files/16965221.pdf

Tang, Tang, and Tracy Bhamra. 2012. "Putting Consumers First in Design for Sustainable Behaviour: A Case Study of Reducing Environmental Impacts of Cold Appliance Use." *International Journal of Sustainable Engineering* 5 (December): 1–16. https://doi.org/10.1080/19397038.2012.685900.

Thaler, Richard, and Cass Sunstein. 2008. *Nudge: Improving Decisions About Health, Wealth, and Happiness*. New York: Penguin.

Thomas, Naomi, and Brenda Goodman. 2022. "The US Is in 'Transition Phase' of Pandemic, Fauci Says." CNN. April 27, 2022. https://www.cnn.com/2022/04/27/health/fauci-covid-pandemic-phase/index.html.

Tobler, Christina, Vivianne H. M. Visschers, and Michael Siegrist. 2011. "Eating Green. Consumers' Willingness to Adopt Ecological Food Consumption Behaviors." *Appetite* 57 (3): 674–82. https://doi.org/10.1016/j.appet.2011.08.010.

Tucker, Corrina A. 2014. "The Significance of Sensory Appeal for Reduced Meat Consumption." *Appetite* 81 (October): 168–79. https://doi.org/10.1016/j.appet.2014.06.022.

Turnwald, Bradley P., Danielle Z. Boles, and Alia J. Crum. 2017. "Association Between Indulgent Descriptions and Vegetable Consumption: Twisted Carrots and Dynamite Beets." *JAMA Internal Medicine* 177 (8): 1216–18. https://doi.org/10.1001/jamainternmed.2017.1637.

UNFCCC. 2021. "A Beginner's Guide to Climate Neutrality." United Nations Framework Convention on Climate Change. February 26, 2021. https://unfccc.int/blog/a-beginner-s-guide-to-climate-neutrality.

Upham, Paul, Leonie Dendler, and Mercedes Bleda. 2011. "Carbon Labelling of Grocery Products: Public Perceptions and Potential Emissions Reductions." *Journal of Cleaner Production* 19 (4): 348–55. https://doi.org/10.1016/j.jclepro.2010.05.014.

US Census Bureau. 2021. "U.S. Foodservice and Drinking Place Sales 2020." Statista. May 2021. http://www.statista.com/statistics/239410/us-food-service-and-drinking-place-sales/.

US EPA. 2016. "Understanding Global Warming Potentials." US EPA Overviews and Factsheets. January 12, 2016. https://www.epa.gov/ghgemissions/understanding-global-warming-potentials.

USDA ERS. 2020. "U.S. Food-Away-from-Home Spending Continued to Outpace Food-at-Home Spending in 2019." Economic Research Service, United States Department of Agriculture. June 15, 2020. http://www.ers.usda.gov/data-products/chart-gallery/gallery/chart-detail/?chartId=58364.

Vaan, Julie M. de, Tommy van Steen, and Barbara C. N. Müller. 2019. "Meat on the Menu? How the Menu Structure Can Stimulate Vegetarian Choices in Restaurants." *Journal of Applied Social Psychology* 49 (12): 755–66. https://doi.org/10.1111/jasp.12632.

Vanclay, Jerome K., John Shortiss, Scott Aulsebrook, Angus M. Gillespie, Ben C. Howell, Rhoda Johanni, Michael J. Maher, Kelly M. Mitchell, Mark D. Stewart, and Jim Yates. 2011. "Customer Response to Carbon Labelling of Groceries." *Journal of Consumer Policy* 34 (1): 153–60. https://doi.org/10.1007/s10603-010-9140-7.

Vennard, Daniel. 2019. "Q&A: How a Cuban Name Change Boosted Panera's Soup Sales." World Resources Institute. February 1, 2019. https://www.wri.org/insights/qa-how-cuban-name-change-boosted-paneras-soup-sales.

Vennard, Daniel, Toby Park, and Sophie Attwood. 2018. "Language of Sustainable Diets." Washington, DC: World Resources Institute. www.wri.org/publication/encouraging sustainable-food-consumption.

Visschers, Vivianne H. M., and Michael Siegrist. 2015. "Does Better for the Environment Mean Less Tasty? Offering More Climate-Friendly Meals Is Good for the Environment and Customer Satisfaction." *Appetite* 95 (December): 475–83. https://doi.org/10.1016/j.appet.2015.08.013.

Wellesley, Laura, Catherine Happer, and Antony Froggatt. 2015. *Changing Climate, Changing Diets: Pathways to Lower Meat Consumption*. London: Chatham House, Royal Institute of International Affairs.

Willett, Walter, Johan Rockström, Brent Loken, Marco Springmann, Tim Lang, Sonja Vermeulen, Tara Garnett, et al. 2019. "Food in the Anthropocene: The EAT–Lancet Commission on Healthy Diets from Sustainable Food Systems." *The Lancet* 393 (10170): 447–92. https://doi.org/10.1016/S0140-6736(18)31788-4.

Wilson, Garrath T. 2013. "Design for Sustainable Behaviour: Feedback Interventions to Reduce Domestic Energy Consumption." Ph.D. Dissertation, Loughborough, UK: Loughborough University. https://repository.lboro.ac.uk/articles/thesis/Design_for_sustainable_behaviour_feedback_interventions_to_reduce_domestic_energy_consumption/9355043/1.

Wilson, Garrath T., Tracy Bhamra, and Debra Lilley. 2015. "The Considerations and Limitations of Feedback as a Strategy for Behaviour Change." *International Journal of Sustainable Engineering* 8 (3): 186–95. https://doi.org/10.1080/19397038.2015.1006299.

Wilson, Garrath T, Tracy Bhamra, and Debra Lilley. 2016. "Evaluating Feedback Interventions:" *International Journal of Design* 10 (2): 87–99.

Wise, Johnathan, and Daniel Vennard. 2019. "It's All in a Name: How to Boost the Sales of Plant-Based Menu Items." World Resources Institute. February 5, 2019. https://www.wri.org/news/its-all-name-how-boost-sales-plant-based-menu-items.

World Meteorological Organization. 2021. "2020 Was One of Three Warmest Years on Record." January 14, 2021. https://public.wmo.int/en/media/press-release/2020-was-one-of-three-warmest-years-record.

Zachrisson, Johannes, and Casper Boks. 2012. "Exploring Behavioural Psychology to Support Design for Sustainable Behaviour Research." *J. of Design Research* 10 (1/2): 50. https://doi.org/10.1504/JDR.2012.046139.

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Appendix

A. Restaurant Recruitment Flyer

B. Phase 1 Research Materials
    1. Protocol Submitted to IRB
    2. Customer Interview Discussion Guide
    3. Manager Interview Discussion Guide
    4. Staff Interview Discussion Guide
    5. Customer Recruitment Flyer
    6. Staff Recruitment Flyer
    7. Customer Interview Consent Form
    8. Manager/Staff Interview Consent Form

C. Phase 5 Research Materials
    1. Customer Exit Survey Participant Recruitment Poster
    2. Customer Exit Survey
    3. Customer Exit Interview Questions
    4. Staff Exit Interview Questions
    5. Manager Debriefing Discussion Questions

A. Restaurant Recruitment Flyer

*A mission to boost sustainable, **plant-rich eating***
in Ann Arbor restaurants

CALL FOR PROJECT COLLABORATORS

I invite an Ann Arbor area restaurant or foodservice business to collaborate in a master of design thesis project to develop and implement a strategy to increase plant-rich eating. This exciting work contributes to the A^{2}ZERO Carbon Neutrality Plan's action to "Support a Plant-Rich Diet."

Our food choices impact our environment, but the trends toward plant-rich eating are promising.

CO$_2$ Increasing the adoption of plant-based diets could **reduce agricultural greenhouse gas emissions up to 80% by 2050.**
(Willett et al. 2019)

57% of US households purchased plant-based foods in 2020, up from 53% in 2019.
(Plant Based Foods Association and Good Food Institute 2021)

Vegan orders on GrubHub jumped up 27% in 2019, and despite the pandemic, they grew an additional 13% in 2020.
(GrubHub Year in Food 2020)

In 2020, **21% of consumers limited animal protein intake to be more environmentally friendly** (up from 16% in 2017).
(Culinary Institute of America 2020)

What is Plant-Rich Eating?
Plant-rich eating reduces the amount of animal products consumed while emphasizing fruits, vegetables, whole grains, nuts, legumes, and seeds.

An Opportunity for Impact
As Ann Arborites return to dining out, restaurants are critical players in supporting people who wish to consume a lower-carbon diet. More importantly, restaurants are positioned to entice everyday omnivores with crave-worthy plant-rich dishes, reducing the environmental impact of their eating choices.

What could we do to promote plant-rich eating?

- In-restaurant educational materials
- Modification of menu structure and visual cues
- Increase amount and variety of plant-rich dishes
- Develop other tailored strategies in this collaborative process

Benefits for the restaurant collaborator:

- Attract the growing market of flexitarians, vegetarians, vegans, and environmentally- and health-conscious customers
- Advance toward sustainability goals and support city-wide carbon neutrality
- Media attention
- Free graphic design services for menus, logos, and supporting materials throughout the project

Project Timeline

Learn
(Sept 1-Oct 31)
Interviews with restaurant owners, key staff, and customers will be conducted to identify barriers and opportunities for adopting plant-based eating in the restaurant.

Concept Generation Workshop
(Mid-November)
Restaurant stakeholders and customers come together to generate ideas to increase plant-based eating based on what we learn from the previous phase. Together we will select a single strategy to develop.

Develop Solution
(Dec 1-Jan 31)
We will work together to design materials to support the implementation of the strategy.

Implementation, Evaluation, and Recommendations
(Feb 1-April 30)
The strategy will be implemented for a set period. Sales data and exit surveys with customers will inform the evaluation.

To learn more, please email Stephanie Szemetylo at **stephsz@umich.edu** or call/text **740-607-3999**

Growing Plant-Rich Eating in Ann Arbor Restaurants: Phase 1

Researchers

Principal Investigator: Stephanie Szemetylo, MDes Integrative Design Candidate, Penny W. Stamps School of Art and Design, University of Michigan

Faculty Advisors (Course ARTDES 761-005: Design Advising):
- John Marshall, Associate Professor of Art and Design, Penny W. Stamps School of Art and Design, University of Michigan
- Hannah Smotrich, Associate Professor of Art & Design, Penny W. Stamps School of Art and Design, University of Michigan

Objective + Background

Phase 1 is an observational study of customer, staff, and owner behavior in a food retail setting. Because the data collection methods consist of semi-structured interviews and facilitated activities about an everyday context (selecting food in a restaurant), the probability and magnitude of harm or discomfort anticipated in the research are not greater than those ordinarily encountered in daily life. The data collected in this study will inform Phase 2 of the research (for which I will prepare a separate IRB application) that will implement and test a single or series of strategies to promote plant-based eating in a restaurant context.

My thesis research project focuses on how restaurants can implement strategies to increase plant-rich eating and decrease greenhouse gas emissions associated with meat consumption. Restaurants have a crucial role in influencing customer behavior and can do so through educational materials, the visual design of the menu, and the quantity of plant-based items on offer. Researchers have studied these and other strategies, yet few have been tested in real restaurant settings. The literature has also not fully addressed the barriers restaurants face in implementation. Additionally, the designs of these interventions have rarely been informed by the people who will be enacting the intervention (i.e., the restaurant), nor by the people affected by the intervention (i.e., the customer), which may lower the probability of an intervention's success. This presents an opportunity to integrate restaurant customer, staff, and owner expertise into a design-facilitated intervention development process.

I am partnering with El Harissa, a local Ann Arbor restaurant, its owners, staff, and customers to co-develop and implement a behavioral intervention to reduce meat consumption. This research is set in Ann Arbor, Michigan because it is a community actively working toward carbon neutrality and has a specific goal to promote plant-rich diets.

The objective of this study (Phase 1) is to establish the current state of plant-rich eating with the recruited restaurant and its customers to identify the factors that influence the selection of plant-based and meat-based dishes. The customer is the key decision-maker in this context and

would be affected by the strategy, so it is necessary to understand their point of view. From the customer perspective, this study will establish: (1) the decision-making process when ordering a meal in the restaurant, what values they consider, and how automatic these decisions are; (2) customers' understanding of the environmental impact of animal products and how knowing this information affects their consumption behavior; (3) attitudes towards plant-based diets; (4) the barriers and enablers for selecting plant-based dishes; and (5) attitudes towards the various types of plant-based promotion strategies studied in the literature.

The restaurant or foodservice business creates and shapes the environment where food decisions are made. To understand their perspective, it will be important to establish with El Harissa: (1) how their menu is developed and what considerations are taken into account; (2) their understanding of the environmental impact of animal products and how knowing this affects what they offer; (3) their attitudes on plant-based diets and dishes; (4) the barriers and enablers in creating and promoting plant-based dishes in their restaurant; (5) what changes they would be willing to make to promote plant-based dishes; and (6) attitudes towards and feasibility of various types of plant-based promotion strategies studied in the literature.

Data Collection Methods

Data will be collected beginning October 25, 2021. I will collect data in two concurrent activities: (1), (2)

Activity 1: Perspectives of El Harissa Owners and Staff
Setting: Zoom
Eligibility: Must be at least 18 years of age and employed by El Harissa
Participant Recruitment: Recruitment of El Harissa staff will be facilitated by myself and one of the El Harissa owners. Recruitment will ensure that staff members are recruited from each of the 3 following staff categories: front-of-house, back-of-house, and management.
Instruments: A semi-structured interview guide (attached to the application)
Data collection: I will conduct in-depth interviews lasting 30-45 minutes using a semi-structured interview guide. All participants will review and sign an informed consent document before starting the interview. I will audio record and transcribe interviews for later analysis with permission from the participant. Audio recordings will be stored in my University of Michigan Google Drive Account and will only be accessible by me and will be deleted 2 years after the end of the study date.
Incentives: El Harissa staff will receive a $25 Visa gift card

Activity 2: Perspectives of El Harissa Customers
Setting: Zoom
Eligibility: Must be at least 18 years of age and have purchased food from El Harissa at least once

3

Participant Recruitment: I intend to recruit 10-15 El Harissa customers using a postcard in two ways: (1) provide El Harissa staff with a set of postcards advertising the study opportunity and have them insert the postcard into customers' orders, (2) I approach customers at El Harissa to inform them of the study and invite them to participate in the study and hand them a postcard with instructions to sign up. The postcard (attached to this application) contains brief information about the study and includes a link and corresponding QR code to a Qualtrics form. The Qualtrics form will contain provide additional information about the study and if interested, the prospective participant will provide their name, email address, and what times they are available.

Instruments: a semi-structured interview guide and facilitated activity on MURAL (screenshot attached to the application)

Data Collection: I will conduct in-depth interviews with individual El Harissa customers lasting 60 minutes using a semi-structured interview guide. During these interviews, I will ask participants about their experience as a customer of El Harissa, their ordering process, and their thoughts on supporting a business that values sustainability. I will also ask participants to engage in a facilitated activity where participants will envision their ideal plant-rich dish using a collection of images depicting various ingredients (vegetables, fruits, nuts, spices, grains, etc) and words that describe the taste, textures, food preparation style, and other attributes. The activity will be completed using MURAL, an online collaboration tool. An example of the activity can be found here, and the mechanics of this activity are described in more detail in the El Harissa Customer Interview Discussion Guide attached to this application. After completion of the activity, I will ask participants follow-up questions about their new dish concept and their attitudes towards plant-rich dishes. Interviews will be audio-recorded and transcribed, and I will collect the dish concepts made in MURAL for later analysis.

Incentives: Participants will receive a $25 gift card to El Harissa upon completion of the interview

Measures to Minimize Risk

Identifying information (name, email) will be collected in the participant consent forms for staff and customer interviews. However, I will not link the identifying information from the consent forms to my interview materials, including handwritten notes, discussion guides, and the facilitated activity. I will assign a code (i.e. Staff 01, Customer 04) to each participant to aid in data analysis without identifying participants.

I will not publish any identifying information of participants in any papers, presentations, or other scholarly venues for the dissemination of research findings unless I have explicit permission from the participant.

I will do everything within my power to maintain the anonymity of my participants and the confidentiality of their identity. Consent forms, interview recordings, and transcripts will be kept in my password-protected University of Michigan Google Drive account. Dish concepts will be kept in my personal MURAL account and a backup will be stored in my password-protected University of Michigan Google Drive account. Only I will have access to these accounts and files. Any information that could identify participants will not be shared.

4

Technology Platforms:
- To conduct the interview, I will be using an enterprise-level Zoom Account held by the University of Michigan. Video, audio, and screen sharing content is protected with the Advanced Encryption Standard (AES) 256. A waiting room and password will also be used to prevent unwanted attendees from entering the session.
- The making activity will be conducted on MURAL. Data produced on MURAL is encrypted with AES-256. Your name will not appear on any MURAL boards unless you wish to include it.

Data Management

Upon completion of the interviews, I will analyze the interview audio recordings and complete dish concepts for themes. Audio recordings may be recorded using Zoom's built-in recording functionality. Recordings and transcripts will be uploaded to my secure Google Drive folder within 24 hours of the interview. I will also be recording handwritten notes during the interviews.

I will assign each interviewee a participant code for analysis purposes, and I will not reveal the identity of interview participants unless they wish to be identified. I will identify and transcribe themes and pertinent quotes to use in affinity mapping. I will keep the project's audio files for 2 years after the study end date for reference purposes, after which I will delete the files. All study files will be kept in my University of Michigan Google Drive, where only I will have access to the files.

Benefits to Participants

Each subject will choose to be involved in this research, and the extent to which they participate. If they choose to participate, they will have the satisfaction of knowing that they contributed to a study that aims to understand the current state of plant-rich eating in local restaurants, which will then inform strategies to promote sustainable, plant-rich eating. El Harissa customer interviewees will also receive a $25 gift certificate to the restaurant as a token of appreciation. El Harissa staff will receive a $25 Visa gift card as an appreciation for their time, as they will be doing these interviews off the clock.

Qualifications of the Researcher

Stephanie Szemetylo is an industrial designer, practicing since 2011. She was an industrial designer and design researcher at Kohler Co before enrolling in the University of Michigan's MDes in Integrative Design program. She has additional design experience in various industries, including accessories, medical devices, and consumer packaged goods.

El Harissa Customer Interview Discussion Guide

Interview Goals and Objectives:
1. Understand the decision-making process of El Harissa customers when they order and what factors they take into account
2. Understand El Harissa customers' attitudes toward plant-rich diets
3. Establish the barriers and enablers to selecting a plant-rich dish at El Harissa
4. Understand the level of awareness El Harissa customers have of the environmental impact of animal products and how it affects their food selections at El Harissa
5. Understand why El Harissa customers, particularly those who participate in the A2R3 Reusable Container Pilot, support a business that values sustainability and takes steps to have less impact on the environment

Interview Overview

1. Introduction and Logistics (3-5 min)

2. Warm-Up Questions

3. Decision-Making Process

4. Making Activity and Discussion

5. Sustainability + Food Choices

6. Closing Questions
   - Anything I might have missed?
   - Any questions for me?
   - Anyone else who might be interested in participating?
   - Ask if the participant has any interest in participating in future research and collaboration on this project (upcoming workshop?)

Introduction and Logistics

Opening
[Greetings, hi and hellos.]

Let me introduce myself…
Hi I'm Stephanie, I'm a design graduate student at the U of M. My pronouns are she/her--may I ask yours? [check w/ participant on their preferred pronouns]

Confirming conditions for participation
Thanks for your interest in this interview. We have about an hour planned for this session. We can skip any questions or stop this interview at any time, for any reason, without any consequence.

Introduce the project and purpose of the interview
For some background, I am collaborating with El Harissa to come up with ways to promote sustainable, plant-rich eating and contribute to Ann Arbor's Carbon Neutrality Plan. I'd like to chat about your experience as an El Harissa customer, your thoughts on plant-rich diets, and how you think about sustainability when it comes to dining at a restaurant.

No right or wrong answers
I'd like to emphasize that there are no "right" or "wrong" answers here. I am here to learn from you.

Any questions for the interviewer
Feel free to ask me any questions during this discussion. Any questions for me before we start?

Permission to record
Ok, I see on your consent form that you are ok with recording this conversation. This will help aid my notetaking and I can be more present in this interview.

Just want to confirm, is it ok if I record this interview?
[Get a Yes/No response]

Okay, great, just started recording. Can I ask you again now that we are recording?

Is it ok if I record this interview?
(Yes.)

Awesome, let's begin.
1. Warm-Up Questions
Could you tell me a little bit about yourself and your experience as an El Harissa customer?
[follow-up below]

3

a. How long have you been an El Harissa customer?
b. How frequently do you come here?
c. Tell me about your favorite dish to get!

Mural Instructions
Great! Before we continue, I want to go ahead and get you set up with MURAL, which is what we'll use for our main activity and fuel our discussion. I am going to send you a link in the chat to our Mural board, let me know if you see it, and please open it.
[send participant-specific link to Mural Board in Zoom Chat]

Ok, great. Mural assigns visitors an animal to keep them anonymous, but you are welcome to type in your first name if you'd like. **[participant types first name if they want to]**

I will give you a quick tour before we start. In the main viewing area, you'll see a long skinny rectangle with some stuff on it. On the left side, I have some images of the El Harissa menu and the refrigerated case with all of their goodies, which we'll talk about first. The right side appears blank, but it's just hidden for now to make the board less overwhelming.

Are you using a mouse or a trackpad with your computer?
- Mouse: use your mouse scroll wheel to zoom, and click and drag to move around the board
- Trackpad: pinch two fingers to zoom, and a two-finger swipe to move around the board
- You can also "follow" me by clicking on my picture at the bottom of the screen

You are free to turn off your video to save bandwidth.

Any questions before we continue? I will give you more instructions later on.

2. Ordering Process
Let's talk about how you order and what you think about when ordering. Could you walk me through the most recent time you visited El Harissa? We can look at the Mural board for reference.
[summon participant to this area on Mural if needed]
a. Purpose:
   i. Who were you ordering for? Yourself? Others? How did those other people influence what you picked?
   ii. What meal(s) (lunch or dinner) did you order for?
   iii. Was this meal eaten soon after ordering, or were you stocking up for later?
b. Did you know what you were going to order ahead of time?
c. Could you tell me about how you interacted with the staff? **[follow-ups below]**
   i. Did you have questions about items on the menu?
   ii. Did the staff make any recommendations to you? Was that influential?

4

    d. Which menus or pieces of information did you reference before ordering? How did they help you decide what to order? **[probe below]**
        i. Online menu
        ii. Print menu at the deli counter
        iii. Cards inside the deli case
        iv. Just looking at the actual packaged food in the deli case
        v. Allergen/dietary symbols on menus
        vi. Is there other information that you wish were on the menu, such as nutrition information, preparation style, or something else?

    e. What sort of things did you consider as you were deciding what to order? **[probe if they get stuck]**

        i. Past experience w/ the item
        ii. Taste
        iii. Price
        iv. Ingredients
        v. Visual presentation
        vi. Description

        vii. Availability
        viii. Try something new
        ix. Staff recommendations
        x. Allergens/Dietary restrictions
        xi. Healthfulness
        xii. Locally-sourced
        xiii. Anything else?

3. El Harissa Test Kitchen: Making Activity and Discussion

Ok, now we're going to move on to our main activity. **[unlock Test Kitchen and summon participant]** I'd like for you to imagine yourself in El Harissa's kitchen and craft your ideal plant-rich dish that would be sold at the restaurant.

[definition if they ask:] "Plant-rich" means an emphasis on minimally processed fruits and vegetables, protein derived from nuts, legumes, and seeds, and reduced consumption of meat and dairy products.

So in this area of the board, we have a bunch of different ingredients. We have veggies, fruit, dairy, plant-based proteins, grains, legumes, nuts and seeds, spices, herbs, and other ingredients that add flavor. The butcher block is your "prep table" where you will be arranging your ingredients to make your dish.

I'd like you to zoom in and browse through these ingredients and drag-and-drop the ones that sound good to you onto your "prep table" **[demonstrate dragging a dropping a couple of images and words into the prep table]**, creating your dish concept.

To emphasize or downplay an ingredient in your dish, you can change its size by clicking on it and dragging the corner. **[demonstrate resizing images]** Feel free to add as many or as few ingredients as you like. I'd also like to reiterate that there are no right or wrong answers here; everyone likes different things. I am curious to know what *you* like.

Great, I'll give you about 5-7 minutes to assemble your dish, and then we'll go on to the next step. Let me undo what I did here so I can give you a fresh kitchen space to work with. Any questions? **[cmd+z a bunch of times until board is back at original state, answer questions]**

I'll be here in case you have questions, need help, or would like to talk through what you're choosing. Otherwise, I will check in in 5 minutes. **[set timer, participant gets started on activity]**

[check in after 5 minutes] How's it going? How about a few more minutes so you can put the finishing touches on your dish? **[participant wraps up dish concept]**

Alright. Before we discuss your creation, I'd now like for you to imagine yourself writing up your new dish for the menu using some keywords. **[reveal menu description section and summon]** I'm going to copy your dish and serve it up on this plate here.

Around your dish, we have words describing preparation methods, taste, texture, and other attributes. Like you did with the ingredients, I'd like you to drag-and-drop the words that you feel describe your dish in and around the plate, and you can make the words larger or smaller to increase/decrease their presence. If there's a word missing that you'd like to include, let me know and I'll get it for you. I'll give you about 5-7 minutes for this. Any questions? **[answer questions and set timer]**

 [check in after 5 minutes] How's it going? Need more time? **[participant wraps up dish concept]**

    a. Ok, chef! Let's chat about your new dish concept. **[allow the participant to explain, follow-up questions below]**
        i. What was your inspiration?
        ii. What led you to choose these ingredients?
        iii. Tell me about [selected ingredient or word]--what does this mean to you?
        iv. What ingredients or words did you avoid? What were your reasons for that?
        v. Any missing ingredients or words from the activity?
        vi. What are your thoughts on plant-based meat alternatives? I noticed you [did/did not] incorporate them into your dish, why is that?
            1. Do you like the taste/texture of them?
            2. If El Harissa crafted a dish that incorporates this type of ingredient, would you consider trying it?
        vii. If you saw this dish in the case at El Harissa, would you buy it?
    b. What are your thoughts on the plant-based options that El Harissa serves?

4. Sustainability + Food Choices

I'd like to end this by discussing sustainability as it relates to food choices.
    a. Is environmental impact something you consider when you are making food choices?

6

b. When you think about the terms "sustainability" and "food," what comes to mind for you?
c. El Harissa has been involved in many sustainability efforts with the Ann Arbor Office of Sustainability, including the A2R3 Reusable Container Pilot Program and Green Fare. As a customer of El Harissa, what does it mean to you to be a patron of a restaurant that values sustainability?

Closing/Wrap Up

Anything I missed?
Those are all of the questions I have for you, thank you for participating in this session. Is there anything else you would like to share with me today? Anything I missed that you would like me to know?

Who else?
Is there anyone in your network who is a customer of El Harissa who would be interested in participating in this type of interview?

[if yes, tell the participant to share with the potential recruit my email and link to the Qualtrics form]

Questions for the interviewer
Do you have any last questions for me?

Incentive Delivery
Mail or pick up at El Harissa?

Openness to follow up?
I would like to thank you again for taking the time to talk with me today. As this project develops, would you be interested in any follow-up from me or further invitations to participate?

[If yes, acknowledge that we'll keep in touch]
[End with another thanks/gratitude, and a warm and friendly closing & goodbye]

El Harissa Management/Owner Interview Discussion Guide

Interview Goals and Objectives:
1. Understand the operational ins/outs of the restaurant
2. Understand customer base
3. Understand how staff interact with customers
4. Identify the barriers and enablers for creating and promoting plant-rich dishes

Interview Overview

1. Introduction and Logistics (3-5 min)

2. A Typical Day/Week

3. Interacting with Customers

4. Creating and Promoting Plant-Rich Dishes

5. Closing Questions

    a. Anything I might have missed?

    b. Any questions for me?

Introduction and Logistics

Opening
[Greetings, hi and hellos.]

Confirming conditions for participation + consent
Thanks for taking the time to chat with me today. We have an hour planned for this session, but we can break it up as needed. You're free to skip any questions or stop this interview at any time, for any reason, without any consequence. I have a consent form that I'd like for you to review and sign. [provide paper form]

Introduce the project and purpose of the interview
I'd like to talk more about El Harissa's day-to-day operations, your customer base, your interactions with customers, and your experience creating and selling plant-rich dishes.

No right or wrong answers
I'd like to emphasize that there are no "right" or "wrong" answers as we're talking here. I'm here to learn from you!

Any questions for the interviewer
Feel free to ask me any questions during this discussion. Any questions for me before we start?

Permission to record
Ok, I see on your consent form that you are ok with recording this conversation. This will help aid my notetaking and I can be more present in this interview.

Just want to confirm, is it ok if I record this interview?
[Get a Yes/No response]

Okay, great, just started recording. Can I ask you again now that we are recording?

Is it ok if I record this interview?
(Yes.)

Awesome, let's begin.

3

1. A typical day/week ["grand tour"]

Let's talk about what happens behind the scenes at El Harissa. Could you walk me through a typical day, or week even, reflecting on the different roles you play? **[probes below]**
 a. Checking in for the day: receiving supplies, food prep, other preparation
 b. Taking orders from customers, assembling orders, payment **[high-level, skip to next section if they start to discuss in more detail]**
 c. Replenishing ingredients and dishes throughout the day
 d. Ordering supplies
 e. Training/communicating with staff
 f. Checking out/closing up for the day
 g. Anything else?

[break if needed]

2. Interacting with Customers

I'd like to talk more about how you and your staff interact with customers and recommend dishes.
 a. We've talked a little bit before about your customer base in previous conversations. How else would you describe your customers? **[probes below]**
   i. New customers vs long-time customers?
   ii. Dietary restrictions?
   iii. Omnivore vs flexitarian vs vegetarian vs vegan?
 b. Ok, so let's say a customer comes in and strolls up to the counter. How would you describe your role as you interact with the customer and take their order? **[follow-up questions below]**
   i. What sorts of things do you consider when making a recommendation to a customer?
   ii. How do you describe the dishes that you recommend?
   iii. How often do customers take you up on your recommendations?
   iv. What kinds of questions do customers have when deciding what to order?
   v. Does any of this change when you are helping long-time customers?
   vi. Any surprising interactions you've had with your customers? (ex: falafel customers)
 c. How does this change when a customer is...
   i. Calling in an order for pickup?
   ii. Placing a catering order?
 d. How do you instruct your staff to interact with customers and make recommendations?

[break if needed]

4

3. Creating and Promoting Plant-Rich Dishes

Next, I'd like to discuss the role of plant-rich dishes at El Harissa.

   a. What trends are you seeing with customers purchasing plant-rich dishes? **[follow-up questions below]**

      i. Which customers gravitate towards these options? Why?

      ii. Which plant-rich dishes are performing well? Why do you think that is?

   b. I'd like to discuss how you create and sell new plant-rich dishes. We can use the Root Vegetable Tagine as an example. Could you walk me through how you developed the dish? **[follow-up questions below]**

      i. What did you take into consideration? **[probes below]**

         1. Cost, flavor profile, preparation, ingredients, customer preferences, something else?

      ii. What were some of the difficulties in developing this dish?

      iii. How has the tagine been selling since its introduction?

      iv. I noticed that the tagine isn't on the print or online menu yet. What are your reasons for that?

   c. Do you see any potential roadblocks with creating and selling plant-rich dishes in the future? If so, what are they?

Closing/Wrap Up

Anything I missed?

Is there anything else you would like to share with me today? I confess that I have very little experience in the restaurant industry. Is there anything that I wouldn't know to ask in this interview with you?

Questions for the interviewer

Any last questions for me?

[End with another thanks/gratitude, and a warm and friendly closing & goodbye]

El Harissa Staff Interview Discussion Guide

Interview Goals and Objectives:
1. Understand the operational ins/outs of the restaurant
2. Understand how staff interact with customers
3. Identify the barriers and enablers for creating and promoting plant-rich dishes
4. Understand what staff know about the links between animal products and environmental impact

Interview Overview (non-management staff)

1. Introduction and Logistics (3-5 min)

2. Warm-Up Questions

3. Interacting with Customers

4. Food, Sustainability, and Recommending Plant-Rich Dishes

5. Closing Questions

    a. Anything I might have missed?

    b. Any questions for me?

    c. Ask if the participant has any interest in participating in future research and collaboration on this project (upcoming workshop)

Introduction and Logistics

Let me introduce myself…
Hi I'm Stephanie, I'm a design graduate student at the U of M. My pronouns are she/her--may I ask yours? **[check w/ participant on their preferred pronouns]**

Confirming conditions for participation
Thanks for your interest in this interview. We have 30-45 minutes planned for this session. Feel free to skip any questions or stop this interview at any time, for any reason, without any consequence.

Introduce the project and purpose of the interview
To give a bit of background on what this is, I am collaborating with El Harissa to design strategies that help promote plant-rich eating and contribute to Ann Arbor's Carbon Neutrality Plan. I'd like to talk about your experience working at El Harissa, how you interact with customers, your thoughts on plant-rich diets, and how you think about sustainability when it comes to food.

No right or wrong answers
I'd like to emphasize that there are no "right" or "wrong" answers here. I am here to learn from you.

Any questions for the interviewer
Feel free to ask me any questions during this discussion. Any questions for me before we start?

Permission to record
Ok, I see on your consent form that you are ok with recording this conversation. This will help aid my notetaking and I can be more present in this interview.

Just want to confirm, is it ok if I record this interview?
[Get a Yes/No response]

Okay, great, just started recording. Can I ask you again now that we are recording?

Is it ok if I record this interview?
(Yes.)

Awesome, let's begin.

B.4. Staff Interview Discussion Guide

1. Warm-Up Questions

Could you tell me a little bit about yourself and your experience working at El Harissa? **[follow-up questions below]**

- a. How long have you been working here?
- b. Can you tell me about the role(s) you have?
- c. Could you walk me through a typical day working at El Harissa?
- d. What's your favorite part about working here?
- e. What's your favorite dish?

2. Interacting with Customers

I'd like to talk about how you interact with customers and recommend dishes.

- a. Let's say a customer comes in and strolls up to the counter. How would you describe your role as you interact with the customer and take their order? **[follow-up questions below]**
    - i. What sorts of things do you consider when making a recommendation to a customer?
    - ii. How do you describe the dishes that you recommend?
    - iii. How often do customers take you up on your recommendations?
    - iv. What kinds of questions do customers have for you when deciding what to order?
    - v. Does any of this change when you are helping long-time customers?
    - vi. Any surprising interactions you've had with your customers? (Reference falafel customers)
- b. How does your role change when a customer calls in an order?

3. Food, Sustainability, and Recommending Plant-Rich Dishes

Next, I'd like to understand your thoughts on *food* and *sustainability*.

- a. When you think about these two terms--"food" and "sustainability", what comes to mind for you?
- b. I am curious to know from you--what are your thoughts on the environmental impact of food choices and the role you might play in helping customers select plant-rich dishes?
    - i. How does environmental impact affect what you recommend to customers?
    - ii. What limitations do you see when recommending plant-rich dishes?
    - iii. What might make recommending/selling plant-rich dishes more successful?

Closing/Wrap Up

Anything I missed?
Is there anything else you would like to share with me today? Anything I missed that you would like me to know? Anything that I wouldn't know to ask?

Questions for the interviewer
Do you have any last questions for me?

Openness to follow up?
Thank you again for taking the time to talk with me today. As this project develops, would you be interested in any follow-up from me or further invitations to participate?

[If yes, acknowledge that we'll keep in touch]
[End with another thanks/gratitude, and a warm and friendly closing & goodbye]

Do an interview and get a
$25 El Harissa gift card!

CALLING ALL EL HARISSA CUSTOMERS!

Let's talk food choices and sustainability in local restaurants!

Over a fun, 60 minute session on Zoom, we will discuss your experience as a customer of El Harissa, and I'll guide you though an activity where you will come up with your ideal plant-rich dish.

To learn more and sign up, please visit:

tinyurl.com/ElHarissaCustomer

For Questions, Please Contact:
Stephanie Szemetylo stephsz@umich.edu

UMich IRB # HUM00207166

Complete an interview and get a
$25 Visa gift card!

CALLING ALL EL HARISSA STAFF!

Want to talk about food choices and
sustainability in local restaurants?

Over a casual, 45 minute session on
Zoom, we will discuss your experience
working at El Harissa, how you interact
with customers, and your thoughts on
plant-rich diets.

To learn more and sign up, please visit:

tinyurl.com/ElHarissaStaff

For Questions, Please Contact: Stephanie Szemetylo   @umich.edu

UMich IRB # HUM00207166

1

Consent for Voluntary Participation: El Harissa Customer Interviews

University of Michigan Penny W. Stamps School of Art & Design

Topic:	Growing Plant-Rich Eating in Ann Arbor Restaurants
Researcher:	Stephanie Szemetylo (stephsz@umich.edu)
Faculty Advisors:	John Marshall (johnjm@umich.edu) Hannah Smotrich (smotrich@umich.edu)

Hello!

I invite you to participate in an interview and activity to explore how restaurants can promote plant-rich eating. This study is part of my design thesis project in collaboration with El Harissa to inform the A²ZERO Carbon Neutrality Plan goal to support plant-rich diets. Please read along to learn about the study and see if you would like to participate. I (Stephanie Szemetylo) will answer any questions you may have.

What does plant-rich eating mean?

Plant-rich eating emphasizes the consumption of minimally processed fruits and vegetables and derives protein from nuts, legumes, and seeds.

What's A²ZERO?

A²ZERO is Ann Arbor's community-wide plan to achieve carbon neutrality by 2030 and was developed by the city's Office of Sustainability and Innovations, community stakeholders, partner organizations, and technical advisors. Adopted in June 2020, the plan sets out seven overarching strategies with 44 actions spanning categories such as renewable energy, improving energy efficiency, and transportation.

What we'll do:

- I will interview you via Zoom video conferencing. Interviews will be about 60 minutes.
- I will ask you questions about your experience as an El Harissa Customer and how you think about food choices.
- Then, I will guide you through an activity using MURAL, a collaboration platform, where you will imagine yourself in the El Harissa kitchen and craft a new, delicious plant-rich dish to sell at the restaurant.

Requirements to Participate

- Be at least 18 years of age
- Have purchased food from El Harissa at least once
- Have access to a laptop or desktop computer with a webcam for the interview and activity

Incentive

In appreciation of your time, you will receive a $25 gift certificate to El Harissa upon completion of the interview and activity.

B.7. Customer Interview Consent Form

Data Handling

- I will be audio-recording the interview to be transcribed for analysis
- I may quote or paraphrase excerpts from the interview, or use an image of your dish concept(s) in papers, reports, and presentations.
- Identifying information (name, email) you provide will not be associated with any content you contribute to the interview or activity
- The answers you provide and the dish concept(s) you create will be compiled with other interviews and will not be linked back to you
- Consent forms, interview recordings, transcripts, and dish concepts will be held in my password-protected University of Michigan Google Drive account. Only I will have access to these files.

Contact

This research is designed and led by me, Stephanie Szemetylo, under the guidance of my advisors, John Marshall and Hannah Smotrich. For any questions, please contact me at stephsz@umich.edu.

If you have questions about your rights as a study participant, have any concerns, or want more information, please contact the Ethics Committee of the University of Michigan (irbhsbs@umich.edu or by phone 734.936.0933).

Confirmation of Participant Consent

☐ I agree to participate in an interview with Stephanie. I understand that my participation is voluntary. I have read the above consent form, and I permit to be interviewed and recorded and the dish concepts I create to be documented.

.

_____
Print Name

_____   _____
Signature   Date

Consent for Voluntary Participation: El Harissa Staff Interviews

University of Michigan Penny W. Stamps School of Art & Design

Topic:	Growing Plant-Rich Eating in Ann Arbor Restaurants
Researcher:	Stephanie Szemetylo (stephsz@umich.edu)
Faculty Advisors:	John Marshall (johnjm@umich.edu)
	Hannah Smotrich (smotrich@umich.edu)

Hello!

I invite you to participate in an interview to explore how restaurants can promote plant-rich eating. This study is part of my design thesis project in collaboration with El Harissa to inform the A[2]ZERO Carbon Neutrality Plan goal to support plant-rich diets. Please read along to learn about the study and see if you would like to participate. I (Stephanie Szemetylo) will answer any questions you may have.

What does plant-rich eating mean?

Plant-rich eating emphasizes the consumption of minimally processed fruits and vegetables and derives protein from nuts, legumes, and seeds.

What's A[2]ZERO?

A[2]ZERO is Ann Arbor's community-wide plan to achieve carbon neutrality by 2030 and was developed by the city's Office of Sustainability and Innovations, community stakeholders, partner organizations, and technical advisors. Adopted in June 2020, the plan sets out seven overarching strategies with 44 actions spanning categories such as renewable energy, improving energy efficiency, and transportation.

What we'll do

- I will interview you via Zoom video conferencing. Interviews will be about 30-45 minutes.
- We will discuss your experience working at El Harissa, how you interact with customers, and the role that plant-based dishes play at the restaurant.

Requirements to Participate

- Be at least 18 years of age
- Are an employee of El Harissa
- Have access to a smartphone or computer with a webcam for the interview

Incentive

Upon completion of this interview, you will receive a $25 Visa gift card as a token of appreciation.

B.8. Manager/Staff Interview Consent Form

Data Handling

- I will be audio-recording the interview to be transcribed for analysis
- I may quote or paraphrase excerpts from the interview in papers, reports, and presentations.
- Identifying information (name, email) you provide will not be associated with any content you contribute to the interview
- The answers you provide will be compiled with other interviews and will not be linked back to you
- I will not reveal to the owners of El Harissa that you participated in this interview
- Consent forms, interview recordings, and transcripts will be held in my password-protected University of Michigan Google Drive account. Only I will have access to these files.

Contact

This research is designed to and led by me, Stephanie Szemetylo, under the guidance of my advisors, John Marshall and Hannah Smotrich. For any questions, please contact me at stephsz@umich.edu.

If you have questions about your rights as a study participant, have any concerns, or want more information, please contact the Ethics Committee of the University of Michigan (irbhsbs@umich.edu or by phone 734.936.0933).

Confirmation of Participant Consent

☐ I agree to participate in this interview with Stephanie. I understand that my participation is voluntary. I have read the above consent form, and I agree to be recorded.

_____
Print Name

_____   _____
Signature   Date

C. Phase 5 Research Materials

C.1. Customer Exit Survey Participant Recruitment Poster

We'd love your thoughts on our menu prototype!

Take our survey while you wait for your order:

tinyurl.com/ElHarissaMenu

No phone? We have paper surveys too!

Thanks for supporting El Harissa today!
We're testing a new menu design and would like to know what you think.

Each dish on our menu now has one of three labels indicating its carbon emissions, as shown on the right:

high **moderate** **low**

1. **Did you understand what these labels mean from looking at the menu today?**

   ○ **Yes**

   ○ **No**

   ○ **I didn't notice the labels**

2. **Did you take these labels into consideration when you were ordering today?**

   ○ **Not at all**

   ○ **Yes, but it didn't change what I ultimately ordered**

   ○ **Yes, and I ordered a lower carbon dish(es) when I otherwise wouldn't have**

   ○ **Yes, and I ordered a higher carbon dish(es) when I otherwise wouldn't have**

We also changed the way we describe our dishes on the menu. See the below example:

Harissa Dip, Before
Harissa, Olive oil, Garlic, Roasted Peppers

→

Harissa Dip, After
A zesty and piquant condiment. Tunisian harissa mixed with EVOO, spices, and sweet roasted red pepper. Add to any of our dishes for a flavorful and spicy kick.

3. **Did these updated descriptions influence your order today?**

   ○ **Yes**

   ○ **No**

   ○ **I didn't notice the descriptions**

4. **That's it! If you have feedback or questions about the carbon labels, dish descriptions, or the overall menu design, please share below:**

   Today's Date: _____

C.3. Customer Exit Interview Questions

After introducing myself and asking permission to take notes, I asked customers a combination of the following questions:

- What do you think of the menu—the board and deli cards?
- Was there anything that surprised you?
- Was there anything that was confusing to you?
- What did you order today? What led you to those choices?
- What did you think of the carbon labeling and descriptions?
- How might learning about the impacts of your food choices change what you order in the future?
- Is there anything you might have done differently with the menu?

C.4. Staff Exit Interview Questions

During slower times in the observation sessions, I asked staff members a combination of the following questions:

- What do you think of the menu board and deli cards overall?
- What kinds of questions or conversations have been prompted by the new materials?
- From your perspective, do you think these new materials have affected how customers order. If so, how?
- Is there anything you might have done differently with the menu?

C.5. Manager Debriefing Discussion Questions

Menu Implementation:

- How have customers reacted to the menu board, deli cards, carbon labels, and descriptions from your perspective?
- How have your staff and your parents reacted to these materials?
- Did customers "get" it?
- What do you think of the new menu materials?
- What might you like to do differently in future iterations?

Overall Process

- How has this project been for you? Is it what you expected? How has it been a value-add?
- How did you find the collaborative process of calculating the carbon labels and writing the menu descriptions?
- How have the carbon labels and learning about the impacts of the ingredients you use changed the way you see things?
- What might you have done differently?
- What would you recommend other restaurant operators do when engaging in this work?