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Comprehensive Food System for Outdoor Use

North Chandler

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a thesis exploration by

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List of Illustrations

Introduction

Enjoying outdoor activities has become a lesson in environmental responsibility and spatial awareness. A hiker must anticipate the equipment that is appropriate for the weather and terrain conditions along with the amount of food and water that will be consumed. Once on the expedition, it becomes the responsibility of the individual to be aware of the surroundings and to minimally affect other people and the environment.

As an outdoor enthusiast concerned with the state of natural areas for recreation and environmental preservation, it seemed appropriate for this project to reflect my personal concerns and passions.

Preliminary ideas for an environmentally conscious and user friendly product included a travel companion that would somehow make you more aware of your impact and surroundings, a hydration system, and a system that was based on the Leave No Trace ethics. These three concepts were evaluated based on their potential as thesis projects.

The hydration system concept focused on the fact that a user may not be aware of their personal hydration status and perhaps there could be a way to monitor this aspect and inform the user so that they could be properly hydrated throughout their physical activity. Although this may be important for performance, the positive influence on environmental awareness was non-existent. The second avenue looked at a portable object that would remind the user how to behave when participating in outdoor activities. The idea of creating something separate and almost useless (aside from the information) is a weak concept and was dropped fairly quickly. However, the concept exploring the application of Leave No Trace principles seemed both expansive and practical.

The focus of this endeavor was not immediately obvious, but initial research proved that the project was viable and had more than enough background information and open-ended directions to support an exploration for a thesis project.

Thesis Proposal

Background
Americans are increasingly using the limited recreational lands in this country. (NPS.gov 2007) The more people use these spaces, the more important it becomes to be pro-active in conserving these limited resources. If Americans alter their behavior, perhaps the lands can be preserved for future generations.

Problem Statement
Leave No Trace is a set of principles designed to reduce human impact on the environment and preserve the wilderness for future generations. The fundamental elements in this philosophy include, for example:

1. plan ahead and prepare
2. travel and camp on durable surfaces
3. dispose of waste properly
4. leave what you find
5. minimize campfire impacts
6. respect wildlife
7. be considerate of other visitors

It is the responsibility of individuals to abide by these rules and care for nature and its inhabitants. "The Leave No Trace Center for Outdoor Ethics believes that while [negative human impact is] widespread and the causes are complex, the solution is simple: change behavior through education, research and partnerships one person at a time" (LNT.org 2006). Perhaps people would be more likely to abide by the principles if there was a product line that explicitly encouraged these ethics through the design.

Thesis Proposal
Design products or a system that inherently encourage outdoor users to abide by Leave No Trace ethics.

Precedents
Outdoor gear has not been designed with these principles as the driving factor. Some equipment exists that has less impact on the environment, but a more direct connection should be made between preservation and use of lands and waterways.

Mission/Goals/Objectives
To make people more aware of the impact users can have on the environment, therefore lessening the detrimental effects humans impose upon nature.

Methodology/Deliverables
Preliminary research will provide the basis for the direction and focus of my thesis. Following the research, sketches, sketch models, and mock-ups will be produced of the outdoor gear. If within the course of the project it becomes appropriate, working prototypes will be created and evaluated based on the following criteria.

Evaluation
This project should be evaluated by the thesis committee and outside sources that may include, but are not limited to outdoor enthusiasts, occasional campers/hikers, conservationists, and environmentalists. The criterion for evaluation is based on the inventiveness and novelty of initial concepts, the effectiveness of applying the Leave No Trace ethics to outdoor products, and the practicality of the final concepts.

Preliminary Timeline
Summer/Fall 2006: initial research
Fall 2006: sketches, sketch models, iteration, in-depth research
Winter 2006/2007: mock-ups and prototypes
Spring 2007: user feedback/testing, evaluation and conclusion

Background Research

The research for this project began with background information on land use in the United States, policies and regulations, the history and application of Leave No Trace and current efforts to minimize human impact on the environment.

The first National Parks Service (NPS) lands were established in 1872 with the declaration of Yellowstone National Park as a federally preserved area. Initially, federal public park lands were instituted to preserve "from injury and spoliation, of all timber, mineral deposits, natural curiosities, or wonders...and their retention in their natural condition" (Davis 1997, p.151). This initial policy implies that guidelines regarding land were more concerned with preserving the land's natural beauty and the resources contained within it rather than preserving the areas for humans to enjoy and use.

As regulations were evaluated and public input taken into account, the common understanding of land use developed into a more anthropocentric interpretation. This shift began with a 1916 mandate declaring that the responsibilities of the NPS include conserving "the scenery and the natural and historic objects and wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (Davis 1997, p.151). The common interpretation of the decree is that of a fair balance between conservation and use. In simpler terms, it means that nature has a right to exist in peace but humans have a right to spend time in and enjoy the lands. Since the policies' inception, this balance has been shifting from one side of the issue to the other according to the current political atmosphere.

Environmental policy began as a bipartisan issue. When the first national parks were established, the general public was not overly concerned with the state of nature and its preservation. The American people only became politically interested in the environment and the stewardship of public lands when there was obvious damage being inflicted on the ecosystem. During the 1960s there was an increased public interest in pollution control and the regulation and preservation of public lands. Representatives from both sides of the political spectrum almost unanimously expressed support for environmental issues (Davis 1997, p.156). Only after the large corporations became financially dependent on environmentally detrimental business practices did issues of preservation and conservation become such politically polarizing topics.

In the time since the mandate of balanced conservation and use was implemented, the 1960s and 70s proved to be the most detrimental to the natural state of the environment. The park lands were made more accessible to visitors through the construction of new roads, trails, parking areas and visitor centers (Marion, 2001). The more visitors came to experience and enjoy the parklands, the more traffic, overcrowding, and littering became major problems. Awareness of the state of the Earth also developed with the increase of green conscious literature, human-initiated environmental disasters and political events including the 1970 Earth Day (Davis 1997, p.155).

Attendance in America's wilderness and park areas has been steadily increasing since their founding in 1872. During the 1960s the number of visitors to the United States Forest Service (USFS) wilderness and primitive lands tripled, resulting in increased littering, erosion and crowding problems in the parks and wilderness areas (Marion, 2001). Legislation and policies were introduced in an attempt to slow the dilapidation of public lands. In 1987, in an effort to educate recreational users and guide park usage, the USFS, NPS, and the Bureau of Land Management (BLM) developed content for and distributed a pamphlet called "Leave No Trace Land Ethics" (Marion, 2001).

Leave No Trace (LNT) was developed by government agencies as an attempt to inform and encourage appropriate behavior for people enjoying the outdoors. The ultimate goal for the LNT program is to "avoid or minimize impacts to natural area resources and help ensure a positive recreational experience for all visitors" (Marion, 2001). Currently, the Leave No Trace Center for Outdoor Ethics is a non profit organization, whose mission is to positively affect outdoor recreation use through education, research and partnerships with businesses, educational institutions, and retailers among others (Marion, 2001). These established LNT principles are the cornerstone for this project and its development.

Leave No Trace

The following principles are the LNT ethics in brief.

Plan Ahead and Prepare
Know the regulations and special concerns for the area you'll visit. Prepare for extreme weather, hazards, and emergencies. Schedule your trip to avoid times of high use. Visit in small groups when possible. Consider splitting larger groups into smaller groups. Repackage food to minimize waste. Use a map and compass to eliminate the use of marking paint, rock cairns or flagging.

Travel and Camp on Durable Surfaces
Durable surfaces include established trails and campsites, rock, gravel, dry grasses or snow. Protect riparian areas by camping at least 200 feet from lakes and streams. Good campsites are found, not made. Altering a site is not necessary.
In popular areas:
Concentrate use on existing trails and campsites. Walk single file in the middle of the trail, even when wet or muddy. Keep campsites small. Focus activity in areas where vegetation is absent.
In pristine areas:
Disperse use to prevent the creation of campsites and trails. Avoid places where impacts are just beginning.

Dispose of Waste Properly
Pack it in, pack it out. Inspect your campsite and rest areas for trash or spilled foods. Pack out all trash, leftover food, and litter. Deposit solid human waste in catholes dug 6 to 8 inches deep at least 200 feet from water, camp, and trails. Cover and disguise the cathole when finished. Pack out toilet paper and hygiene products. To wash yourself or your dishes, carry water 200 feet away from streams or lakes and use small amounts of biodegradable soap. Scatter strained dishwater.

Leave What You Find
Preserve the past: examine, but do not touch, cultural or historic structures and artifacts. Leave rocks, plants and other natural objects as you find them. Avoid introducing or transporting non-native species. Do not build structures, furniture, or dig trenches.

Minimize Campfire Impacts
Campfires can cause lasting impacts to the backcountry. Use a lightweight stove for cooking and enjoy a candle lantern for light. Where fires are permitted, use established fire rings, fire pans, or mound fires. Keep fires small. Only use sticks from the ground that can be broken by hand. Burn all wood and coals to ash, put out campfires completely, then scatter cool ashes.

Respect Wildlife
Observe wildlife from a distance. Do not follow or approach them. Never feed animals. Feeding wildlife damages their health, alters natural behaviors, and exposes them to predators and other dangers. Protect wildlife and your food by storing rations and trash securely. Control pets at all times, or leave them at home. Avoid wildlife during sensitive times: mating, nesting, raising young, or winter.

Be Considerate of Other Visitors
Respect other visitors and protect the quality of their experience. Be courteous. Yield to other users on the trail. Step to the downhill side of the trail when encountering pack stock. Take breaks and camp away from trails and other visitors. Let nature's sounds prevail. Avoid loud voices and noises.

Source: http://lnt.org/programs/lnt7/index.html

Environmental Philosophy

As my research continued, the varying perspectives on environmentalism and my interpretations of what it means to be environmentally responsible became more pertinent to the project. How could I complete this task without clearly acknowledging my personal viewpoint? The assimilation of my experiences and research would understandably affect the outcome of the project.

Aldo Leopold was among the earliest and most influential environmentalists. From Leopold's perspective, the current conservation perspective does not address the scope of the environmental crisis. "A conservation system based wholly on economic motives [does not take into account] that most members of the land community have no economic value…these creatures are members of the biotic community, and…they are entitled to continuance. When one of these non-economic categories is threatened, and if we happen to love it, we invent subterfuges to give it economic value" (Leopold 1981). America has become so dependent on the capitalist notion of society that nature is only seen to have value when it is used as a commodity. Leopold believes that the natural world should be viewed as a member of the community rather than a product assigned an arbitrary economic value. Humans are morally obligated to extend nature its rights as a member of the biological community.

Concern for the state of the Earth and the relationship humans have established with nature has moved some environmentalists to declare that humans are morally and ethically obligated to extend rights to Nature. This perspective spawned from Aldo Leopold's research and writings and has been labeled as Radical Environmentalism (Nash 1989). The logic behind Radical Environmentalism is that people have always unfairly expressed their domination over others who are deemed less than worthy of equal rights and Nature is one of the subjugated factions. From an historical perspective these oppressed groups have included colonized peoples, women, slaves, and Native Americans. The current view of Radical Environmentalists is that Nature itself is being unjustly robbed of its rights as a member of the biological community.

In addition to Radical Environmentalism, there are numerous labels for conservation movements and belief systems including resource conservationism, preservationism, biocentrism, ecocentrism, deep ecology, and ecofeminism (Oelschlaeger 1991). The basic conservationist values are that humans are separate from nature and that natural resources are valued by their economic worth and usefulness. This perspective is precisely the narrow outlook that Leopold warned against: an incongruous and arbitrary application of economic value on the biological world. One common assessment as to how this perspective was adopted so readily is that the Judeo-Christian culture promotes human dominion over all things natural (Oelschlaeger 1991). "Christianity is the most anthropocentric religion the world has seen…we shall continue to have a worsening ecologic crisis until we reject the Christian axiom that nature has no reason for existence save to serve man" (Merchant 2003, p. 5). Even though not all Judeo-Christians believe in this ultimate supremecy and domination, this perspective has nonetheless anchored itself in the Western belief system. This narrowed Judeo-Christian narrative has been adopted as legitimate, thereby forming the current direction of human interaction with the environment. In my view this is an unfortunate path that western culture has come to blindly follow.

My personal philosophy lies within the realm of preservationism. The idealist, and preservationist part of me believes that humans are capable of acknowledging that our species as an integral element in the natural ecosystem and should act accordingly. The realist within me recognizes that most individuals have philosophically removed themselves from the natural world and are most likely aligned with the resource conservationists; whether this is a result of religious beliefs or an adopted cultural concept does not matter, it became the ethos of the many of industrialized nations. I recognize the technological advances and modern amenities that humans have come to depend on for survival and convenience. Unfortunately, I have little faith in the current policy and decision makers to enact changes that would alter the modern perception of human superiority over all things natural. I believe that we have a responsibility to repair as much of the damage as is possible and move forward with responsible and conscious living. Although humans currently express dominion over our natural counterparts, I hope that we will one day reestablish a more respectful manner of existing.

Businesses and American Consumers

In and effort to gauge the atmosphere in which products are developed, I researched the American consumer culture and the common perception of environmentally sustainable design and business standards. As expected, this part of my researched indicated that there is a growing trend toward green design and business practices. Although American consumers are devoted to their material lives of consumption, they are now more open to spending their money on green products. The rise in green conscience businesses guided my research into an in-depth look at several businesses that are attempting to preserve a sense of environmental and social responsibility. Through this exploration, I was able to gain a better understanding of the current obstacles to designing a product system that is focused on improving the relationship between humans and the natural world.

One of the current business standards for many United States companies emphasizes short-term financial gain, while giving little regard to long-term environmental, societal, and economic damage, both locally and globally. The perpetuation of the capitalist business model finds its roots in North America's Puritan tradition and the historically ideal 'American Dream'. Hard-working laborers believe that the harder they work, the greater the benefits they will reap. While this notion may hold true in agricultural-based societies, cultures whose business are based on technology require different strategies. Often, working smarter rather than working harder or more quickly will produce better results with fewer damaging effects on the environment.

Americans buy into the consumer notion that increased ownership elevates one's social status (De Botton 2004). This perception, when combined with a capitalist economy that relies on ever-expanding financial growth, is rapidly pushing the environment to a breaking point. Natural resources are being depleted faster than they are replenished. "Sometime in the next hundred years, if [the] current trends in population growth, industrialization, and resource depletion continue(s) unchanged, [then] the world [is facing] actual physical limits to growth...Prosperity could be preserved, but only by changing the trends" (Hawken 1999, p.144-145). If industries do not change their perceptions of accountability and take responsibility for their actions, the Earth and the economy may not be able to recover.

Americans are slowly gaining a new perspective on their environment. Individuals have begun to take increasing interest in natural resources and the environment. In 2003, environmental conservation group membership totaled 15.8 million in the United States. More specifically, the Wilderness Society experienced an increase from 110,000 members in 1984 to 390,000 members in 1990 (LNT.org 2006; Davis 1997). However, the United States' will not become a more environmentally conscious nation by increasing people's awareness of their surroundings, but rather by increasing awareness of the connection between consumer products the effect their production, distribution and consumption have on the environment (McDonough 2002).

Numerous companies have begun to lead consumers down a path of awareness and responsibility. These businesses have assumed responsibility for their impact on the ecosystem and let long-term impact, rather than short-term financial gain, dictate their actions. Consumer response to a degrading natural environment has been primarily laissez-faire: as long as the economics are positive, change to the system are viewed as unnecessary. Therefore, businesses like Patagonia and Stonyfield Farms have taken on the responsibility of providing alternative products that have less of a negative impact on the environment.

Companies in Practice

Patagonia

Patagonia is a California-based outdoor gear manufacturer and supplier founded in the 1970s with the modest goal of providing high-quality goods to outdoor enthusiasts. Patagonia produced performance gear from materials that were durable and functional, yet sometimes environmentally unsustainable and slightly toxic to humans. As the business grew, founder and owner Yvon Chouinard wanted to give something back to the environment that had inspired his business venture.

In 1996 Patagonia took its first step as an environmentallyprogressive company by choosing to use organic cotton in its products (Rosenblatt 1999). While the company initially lost 20% of its cotton clothing sales, today's garments are now more popular than they were before the fiber change. Chouinard attributes this growth to a more comprehensive design philosophy, stating, "A designer who begins with a bale of cotton takes his task seriously. He makes something more worthwhile" (Rosenblatt 1999). Accountability is essential to the alteration of businesses' functioning.

Extensive material research enables Patagonia to recycle garments in order to decrease environmental impact: "research shows that the environmental impact of recycling worn-out Capilene® base layers into one new polyester fiber is significantly lower than making that same fiber from virgin materials" (Patagonia.com 2006). Additionally, the Patagonia service center is built according to Leadership in Energy and Environmental Design (LEED) certification standards.

Patagonia does not merely inspire advancement internally, but dedicates itself to change in and beyond the United States. The Patagonia Employee Internship Program financially supports employees for up to two months while they donate their time and expertise to an environmental group of their choosing. Patagonia provides funding for the restoration and protection of the Patagonia region in South America, and heads the Vote for the Environment campaign – an initiative that encourages consumers to vote for politicians who pledge to help the environment. Additionally, Patagonia is a member of 1% for the Planet, "an alliance of businesses committed to leveraging their resources to create a healthier planet. Members ... donate at least 1% of their annual net revenues to environmental organizations worldwide. The alliance aims to prove that taking environmental responsibility is good for business" (1% FTP 2006). Because Chouinard believes that Patagonia exists to prevent "environmental collapse...to try to clean up our own act, and try to influence other companies to do the right thing, and try to influence our customers to do the right thing," Patagonia has become a leader in environmentally-conscious corporate philosophy.

Stonyfield Farms

Stonyfield Farms produces organic dairy products in Londonderry, New Hampshire. The company was founded to promote health through the use of natural and organic ingredients, and is committed to minimizing its ecological footprint via comprehensive waste management, conservation of energy, and support of local farmers and environmental and social groups.

Stonyfield minimizes its impact on the environment in part by reducing solid packaging waste. They use recyclable plastics and lightweight materials to reduce the amount of energy used during shipping and allow for product recycling. Stonyfield recycles the material into other products such as razors, toothpicks, and tableware (Recycline.com 2006). Their foil lid has reduced the energy used in manufacturing by 16% and solid waste by 6% (Stonyfield.com 2006). At the facility, solid waste is reduced by donating unusable yogurt to local hog farmers to feed to the livestock.

As with Patagonia, social activism is an important part of Stonyfield Farms' corporate ideals. The company donates 10% of its profits toward the protection and restoration of the Earth. Because family farms are an important resource for dairy product manufacturers, Stonyfield has helped convert many into organically certified farms, thus strengthening the quality of their products and communities. They are proactive in self-assessment and consumer education; they promote environmental change by distributing information about their packaging as well as other environmentally conscious business practices on their website.

Assessment

Though still in its infancy, a shift in consumer expectations, perception and habits is developing. Positive steps are being taken as part of a push toward environmental sensitivity, though too few are concerned enough to change their consumers habits. The public will not respond substantially until the monetary costs of consumable products reflect their environmental impact. The efforts of some companies help, but more need to become involved and address the situation adequately. Issues of population control and global warming have eclipsed the 'American Dream', and everyone must begin to implement progressive solutions.

Considering these trends toward environmental sustainability in practice, this thesis project seems well-suited for today's American consumers. American's are becoming more self-aware in their consumption and purchasing decisions. If purchasing a slightly more expensive item means that the environment will be impacted less, conscious consumers are willing to spend that money. Therefore, the market seems primed for an item that explicitly lessens human impact on the natural environment.

Preliminary Directions

After the initial research phase was completed, the project problem was redefined to mean that recreation should not become tedious or burdened by a set of rules, but instead integrate responsibility and awareness into the product so that the user will naturally abide by the principles during normal product use.

One of the main purposes of these initial directions was to make the user aware of their impact on the land and how their actions may affect the environment. This goal could possibly be achieved through pamphlets, proper equipment selection and educational signage among others. Another feature that could be integrated into the solution is to give people a tangible connection to the local environment, perhaps by using natural history facts specific to the area. Another goal was to simplify adherence to the LNT ethics by making a product that would help the user abide by the principles through everyday use. These preliminary goals were considered during the first stages of the design process, but were altered slightly as the project became more focused.

A large part of the design process at this stage in the project was discovering and defining the source of the problem rather than identifying the obvious issues and attempting to fix the problem rather than the reason for the problem.

Toward the beginning of the research and development phase, several directions were selected as exploration paths. By narrowing the number of areas to explore, the project became more manageable but remained open-ended enough to shift the focus if one or more of the avenues lead to an impasse in the product development phase. These avenues were chosen for reasons including: a direct connection between the LNT ethics and the topic, the potential for creating a product or a system, and the potential for product use and practical application.

Energy Consumption

Energy use during an outdoor excursion draws from sources including batteries, gas and firewood. Both gas and batteries are brought in from an exterior supply to be consumed during the trip. Firewood is taken from the surrounding wilderness and can leave an area scarred and depleted of tinder. The initial assessment of energy consumption examined these aspects as two distinct problems.

The first issue I began to tackle was that of using energy that is transported from one place to be used in another. In other terms, items such as batteries and liquid gas or fuel pellets that are brought from a user's home into the wilderness. I approached this investigation by first questioning the need for bringing energy in from an external source. The inspiration for this notion originated with a conservation concept that argues for the use of local resources and fuels (McDonough 2002). By consuming power that is produced locally, less energy is wasted in the transportation of the item. Another potential advantage of a system could be that the energy used during a person's time outside is produced by the recreational activities themselves; the downward motion of a footstep could become the motion that powers a headlamp.

At this point I set about researching ways energy produced from human movement could be transferred to a storage unit from which power could be drawn when needed. There was one product that was still in the developmental stages that caught my attention: boots that converted walking into battery power. The United States Defense Department is working with a research firm to develop footwear that creates electrical power from the downward motion of a walking foot (Eng 2006). One of the major disadvantages of this prototype is that a lot of the produced energy is lost during the transfer and storage phases. If I followed this course, more research would need to be made in electronics and power storage. However, this part of the project was abandoned after the initial research phase because, to me, other options were more pertinent to the essence of the problem I was attempting to solve.

One of the main LNT tenants is to minimize the impact of campfires. Currently, using a campfire on a camping or hiking trip is a matter of personal preference rather than a necessity. Modern flashlights, camp stoves and sleeping bags are capable of creating enough warmth and light to supplant the use of campfires. Despite these advances in technology, nothing has yet been able to replace the comfort of the sound of crackling logs or the social ritual of gathering around a burning fire. (Hampton, 2003) Although these reasons are not matters of necessity, they are valid reasons, especially since participating in outdoor activities is primarily for entertainment purposes.

Finding a solution to the fire issue began with the belief that modern advances in outdoor gear have made the necessity of a campfire dissipate. Moving forward with this idea, I identified the appealing aspects of a fire in hopes that those characteristics could be achieved in some way other than actually building and lighting a fire. These features include: a central source of warmth, cast light, flickering internal light, crackling logs creating ambient noise, and a source of heat for cooking.

The replacement product would need to be an object that would encourage people to gather around it and also cast a circle of comforting light. The initial brainstorming process resulted in the rudimentary beginnings of a fire simulator. The features of this product included a collapsible dome-like structure with a central light source, secondary lights that simulate flickering flames, and it would be capable of running off stored solar power, hand crank power and backup battery power if both the sunlight and human motivation are lacking. As with the previous energy-focused exploration, this path was truncated during the initial stages in order to concentrate on other elements of the project.

Erosion

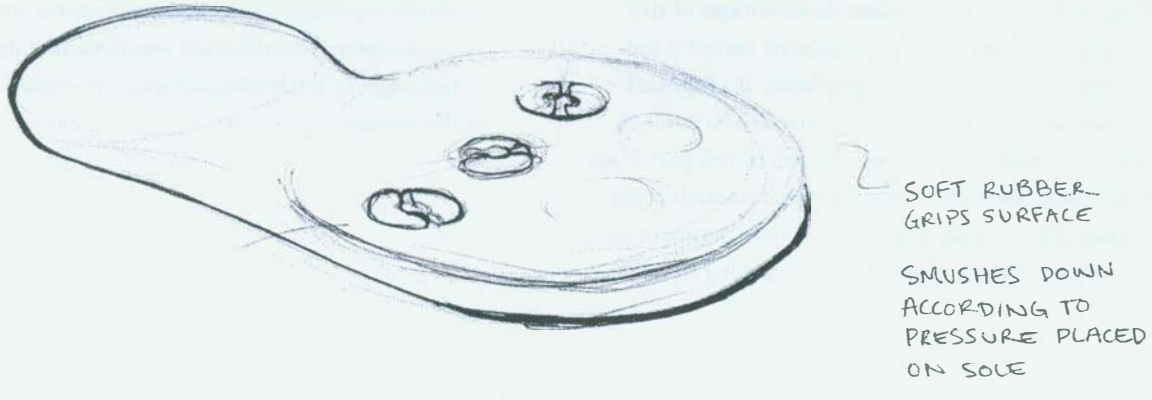
Erosion is a naturally occurring phenomenon. Rivers, weather, climate change, natural disasters, and changes in vegetation concentration are all contributing factors to erosion. However, it is not these natural incidents that are the concern of this project, it is the effect that recreation users have on the wearing away of the earth. In order to minimize human impact on erosion, it was necessary to first identify the primary behaviors that negatively affect the integrity of the ground. The major factors include people hiking off-trail (whether this is intentional or accidental, the actions produce the same damaging result), hiking on trails too early or too late in the season when the conditions are too wet and the ground in fragile, improper campsite selection, and using heavy-duty hiking boots when sneakers or light-hiking shoes would have sufficed. (Hampton, 2003)

Detrimental behavior most often occurs because the user is unaware that his or her actions are damaging to the environment. (Hampton, 2003) For this reason, dissemination of information is one of the most important aspects of the Leave No Trace. People who enjoy outdoor activities are generally inclined to preserve the resources they enjoy rather than destroy it. Therefore, if awareness is made an integral part of the recreational activities themselves, perhaps the education portion of LNT would be more successful in reaching its intended audience.

One of the problems previously mentioned is the fact that people are walking off-trail during their excursions. There are several reasons for deviating from a designated path: one of which is cutting a switchback (a section of the trail that cuts back on a steep slope) in an effort to reduce the distance of a hike. To some people this action seems innocent because they are under the misconception that switchbacks exist solely to ease the strain of a steep climb. Although one of the purposes of switchbacks is to create a more gentle climb, the primary reason trail crews create the winding path is to reduce the amount of erosion that would have been created by a straight path. When vegetation is allowed to grow on the spaces in between the switchbacks, it has a better chance of holding the hillside together with its roots than if the trail cuts straight up the slope. Therefore, when hikers cut the corners of switchbacks, the plants in those areas are destroyed, increasing erosion and human impact on the area.

Wet or muddy trails are also instances when recreation users are more likely to walk off the path and erode the surrounding area. A hiker will sometimes walk around the difficult area and therefore create a larger problem by degrading the surrounding soil and widening the area affected by standing water. Although a hiker's footwear may become muddy or damp as a result of walking through the watery section, it is far less damaging to the integrity of the ground.

Fig. 1-1 Different rubber stiffness on boot sole



Trail erosion can be accelerated by many things, including rugged footwear. Heavy-duty hiking boots are more detrimental to the ground than alternative footwear including sneakers and moccasins because of their inflexible nature and deeply grooved treads. One study suggests that a single hiker walking one mile will lift approximately 120 pounds of soil from the earth, leaving this material susceptible to being washed off the trail. (Hampton, 2003) The footwear selection for a trip should reflect the terrain and the amount of weight being carried; lighter footwear will lessen negative impact a recreational user has on the ground.

These three issues, walking off a trail to reduce the amount of distance to travel, avoiding damp areas on a footpath, and wearing too-rugged footwear, are the problems I chose to tackle for this portion of the project. From personal experience and LNT resources I identified the primary reasons for these actions: reduce the amount of time or distance traveled, concern for personal safety, unclear trail markings, improper drainage, inadequate planning, and ignorance of the negative impact their actions have on the environment. After having established the problems and the reasoning behind the detrimental behavior, I then began to explore possible solutions.

Fit, comfort, durability, and safety are all factors people consider when selecting shoes for an outdoor excursion. Generally, one of the last things thought about, if it is at all, is how the footwear will affect the ground. After discovering how detrimental overly robust shoes can be to the soil, I thought that perhaps the soles could retain their ability to grip the ground while lessening the amount of earth that is separated from the surface.

In this vein, I began by looking at animal and human feet. In their natural state, they are flexible and are able to grip the ground more effectively than if they were straight and stiff. The sole is an extension of the human foot, so the characteristics of the foot should be reflected in the way the sole interacts with the ground. The bottom of the sole I began to design was fairly flat with slightly raised spots of rubber. (Fig. 1-1, Fig. 1-2) These spots would be made of a softer material than
the rest of the sole and would be pushed up into the harder rubber when pressure is applied. The more pressure place on the soft rubber, the more it compresses into the stiffer material. When pressure is lessened, the softer rubber returns to its slightly raised position. In this way, I hoped to reduce the amount of material that is lifted from the ground during outdoor activities. Similarly to the previously mentioned avenues of exploration, this too remains as a preliminary concept and was not refined to a conclusion.

Fig. 1-2 Layouts for differing rubber stiffnesses

The remaining two issues on the subject of erosion are similar enough that they were melded into a single investigation concerning walking off-trail. The majority of hikers who walk off trail, whether it is to avoid mud or cut time and distance off a trip, are unaware that their actions negatively affect the environment. (Hampton, 2003) If users are made aware of the effect their actions have on the places they are enjoying, perhaps they would be less likely to participate in the questionable behavior. Sometimes it is difficult to judge the condition of a hike from home or even at the trailhead, so footwear selection is based on a perception rather than accurate information. Therefore, the preliminary solutions for these issues included clear signage, education of users, and proper equipment selection.

Trailheads are generally places where information about the area and trail are communicated to recreation users. Maps, sign-in logs, and general rules are commonly seen at an entrance to a hike. If there is any mention about trail conditions, it is a general "hiker beware" sign rather than dissemination of useful notifications. In relation to this project, one of the most practical pieces of information excluded from the trailhead is the amount of moisture on the trail. Dry ground make trails easier, so perhaps during these times the user would wear lighter footwear if he or she is made aware of the condition of the route. (Fig. 2-1) Hikers should not use a very wet trail because of the damage they would cause. If the path is damp, with some muddy sections,
a user may choose specific equipment, including footwear and gators, appropriate for the conditions. During these situations, the hiker should also be made aware that hiking through a bad section is much better than walking around it, which only creates a larger muddy section. Initial design considerations dealt with clear trailhead signage that would inform the user of trail conditions as well as proper actions to take during each situation.

Fig. 2-1 Signage for moisture on trail

Fig. 3-1 Light hiker gator

In bad trail conditions, a hiker may be inclined to wear heavy-duty footwear. Instead of changing into a shoe whose sole may cause damage to the ground, perhaps the top of the shoe could become more appropriate for the conditions. In this way, a lightweight shoe could be used for most conditions, from dry to wet. I began this part of the exploration with an adaptation of the boot gator. (Fig. 3-1) The item is lightweight and waterproof and would keep the top of the shoe dry from mud and water. Shorter and more lightweight versions would be used for drier ground while taller and more durable gators would be developed for less than favorable trail conditions. The state of the gator concept remains at this stage, but has potential for further exploration in the future. As with other aspects of this project, this idea could be developed into a complete product with additional research and development.

Food Waste

Originally, it appeared as though this part of the project would be more about education, information systems and signage than anything else. This is because a large part of the LNT system is about education and it seemed fitting that the project would move in that direction. Despite this initial thought, this project moved in the direction of a product system that would help any user overcome their lack of knowledge, carelessness and improper planning so that they would automatically follow the LNT principles when using the product.

One of the first design concepts to arise from the food waste section was labeling food packaging with informative but playful messages. Personally, I have encountered numerous individuals who believe that giving food to wild animals and throwing leftovers into the woods is completely acceptable behavior. These actions are wrong for several reasons. When animals are fed by humans, they become accustomed to being given food without having to forage for it themselves. Creatures are then more likely to starve during times when food is scarce. Having learned that food is available, the animals are also more likely to wander into areas where humans congregate. Once this familiarity occurs, animals become a nuisance to people and are sometimes killed as a result. The belief that giving an animal food is an act of charity is a misconception that should be dispelled.

One method that could be employed to discourage improper behavior is to label food packages commonly used as snacks during outdoor activities. (Fig. 4-1) Lecturing individuals and giving them rules are not effective ways to change behavior. Instead, it seemed more appropriate to establish a clear boundary between what humans eat and what animals eat. I began exploring graphic solutions for the label, but the project progressed toward a different solution and in an effort to produce a well developed product, the graphic portion was dropped.

Fig. 4-1 Educational Snack bag lable

Fig. 5-1 Snack bag with protective ribs

Fig. 5-2 Snack bag with pouch to catch food

A secondary route that I explored at this time was preventing food crumbs from forming and eventually falling on the ground. Users are much less likely to notice the loss of small crumbs than they would larger chunks of food. Altering the food packaging so it is better able to protect the food from crumbling seemed like a worthy means to an end. I began by creating sketch models of plastic bags. The first example is part of a series with integrated ribbing that easily folds up when there is less food in the bag, but is capable of protecting the contents from being crushed from the side. (Fig. 5-1) Other examples have alternating ribs that form a cube-like structure. These bags could also be folded down so that they occupy the same amount of space as a regular plastic bag.

The purpose of additional sketch models produced at this time was to catch food that might fall during consumption. When the bags are opened, the mouth of the containers become wide so that any spilled food will fall back into the bag instead of on the ground. (Fig. 5-2) In this way, the amount of food that is left on the ground for animals to consume is reduced. These preliminary sketch models piqued my interest in pursuing the path of food packaging for outdoor activities. There are so many instances during a trip when food can be prevented from ending up on the ground: eating snacks, preparing a meal, during a meal, and cleaning up after eating. I began intensely explore this path as the focus for my project.

Motivation Brainstorming

In an effort to establish the underlying reasons for detrimental behavior in outdoor activities, I developed a mind map. (Fig. 6-1) In this way, I hoped to discover the basic causes for behavior in the wilderness.

I began with some of the larger issues that LNT addresses, including erosion and waste, and broke them down into core rationales for each subject. The analysis is based on personal experience and background research. This examination influenced the way I approached finding solutions for this project: ultimately, I became most concerned with guiding users to abide by the LNT principles simply by using any product I would develop.

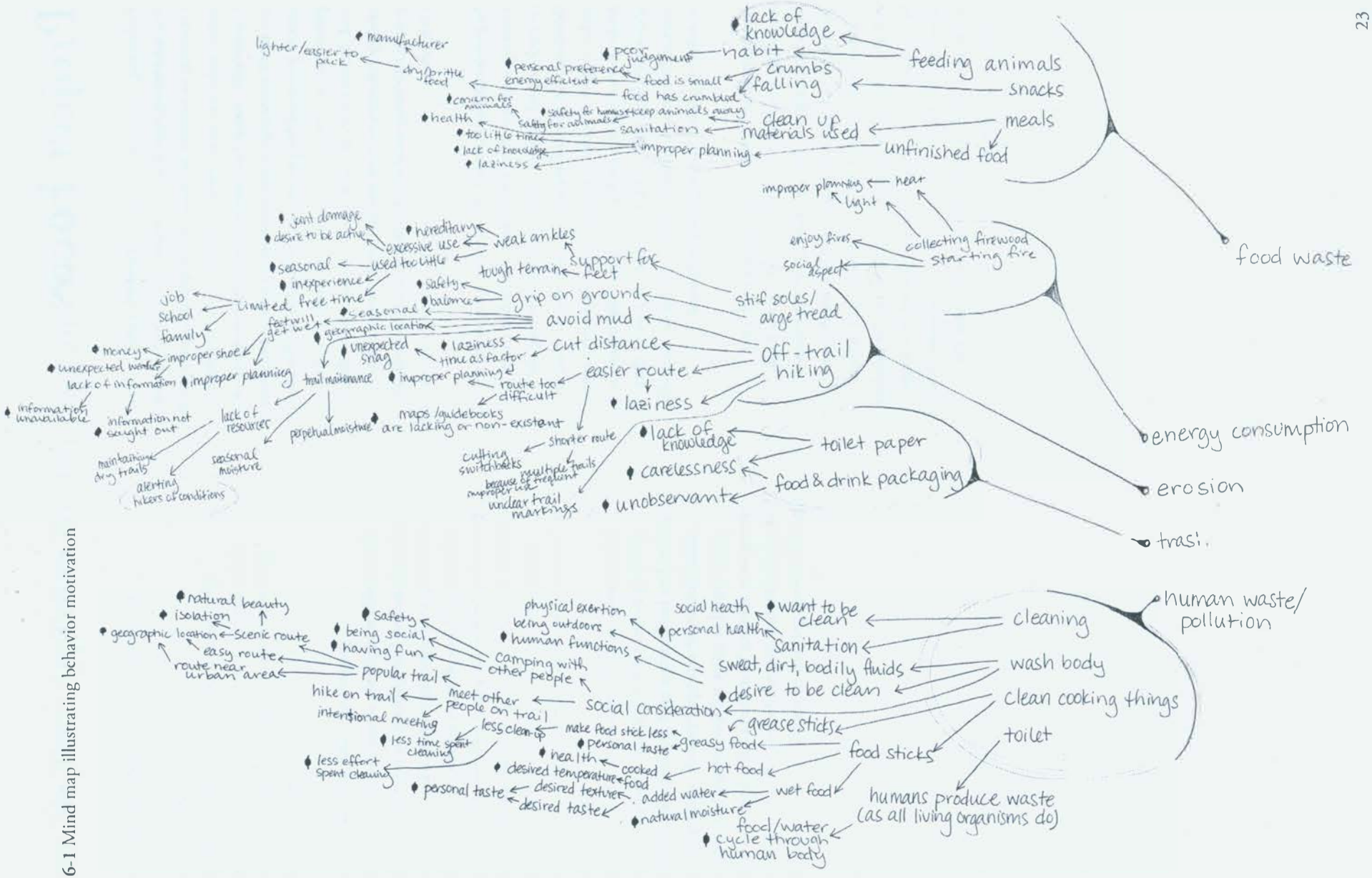


Fig. 6-1 Mind map illustrating behavior motivation

Project Focus

Following the initial research and preliminary brainstorming regarding the main topics I had chosen, I decided to narrow my focus and expand upon a single topic: reducing food waste during outdoor activities. I made this choice because it was closely entwined with the LNT principles and I believed that the subject had ample potential for product development. If this path proved to be unworthy of pursuit or came to a dead end, I could then go back to one of the other topics, energy consumption or erosion, and continue the product development and brainstorming from where I left off.

As previously mentioned, this project progressed into creating a system that encourages recreation users to pack in and pack out their supplies. During the development stages I wanted to name the product in order to give it more meaning to the consumers and make marketing less ambiguous. Since the system is about traveling with food, I decided on a word that essentially means constant travelers: Gitanos. Literally translated, *gitanos* means *gypsies* in Spanish.

The purpose of Gitanos is to alleviate problems including food falling on the ground, excess food, food bits scattered during cleaning, and overcome any user's lack of knowledge. In other words, even if a user is unaware of the LNT ethics, their actions will abide by the principles when they use the product. At this point I was ready to move forward in a single direction. I took this opportunity to look more closely at the LNT principles on which I was basing the concept of my project.

Leave No Trace Applied to Food Storage and Waste

Source: http://lnt.org/programs/principles.php

Plan Ahead and Prepare

Adequate trip planning and preparation helps backcountry travelers accomplish trip goals safely and enjoyably, while simultaneously minimizing damage to the land.

One-Pot Meals and Food Repackaging

- Planning for one-pot meals and light weight snacks requires a minimum of packing and preparation time, lightens loads and decreases garbage. One-pot meals require minimal cooking utensils and eliminate the need for a campfire. Two backpack stoves can be used to cook all meals for large groups if you have two large pots (one large pot can be balanced on two stoves when quick heating is desired). Remember, a stove Leaves No Trace.
- Most food should be removed from its commercial packing and placed in sealable bags before packing your backpacks. Sealable bags secure food and reduce bulk and garbage. Empty bags can be placed inside each other and packed out for reuse at home. This method can reduce the amount of garbage your group must pack out at the end of the trip and eliminate the undesirable need of stashing or burying unwanted trash.

Dispose of Waste Properly

- Pack it in, pack it out. Inspect your campsite and rest areas for trash or spilled foods. Pack out all trash, leftover food, and litter.
- To wash yourself or your dishes, carry water 200 feet away from streams or lakes and use small amounts of biodegradable soap. Scatter strained dishwater.

Respect Wildlife

- Never feed animals. Feeding wildlife damages their health, alters natural behaviors, and exposes them to predators and other dangers.

Precedents for Food Transport, Cooking, and Consumption

Currently, the outdoor gear market does not have a product that accommodates food throughout the length of an excursion. Products like this exist in other markets including the United State's military's meals ready-to-eat, Kraft's EasyMac, and Wolfgang Puck's self-heating coffee cup. All of these items can be transported, heated, consumed and disposed of in a single container. Unfortunately, all of these products also generate waste once the consumable items have been devoured.

Food-centric products in the outdoor industry tend to focus on a single aspect of the journey rather than a comprehensive overview. A product may address the issues of transportation, cooking, consumption and disposal separately but neglect to examine the subject of "food" as a whole. Products like the Jetboil cooking system, the multitude of freeze-dried foods available at most outdoor gear stores, and portable lunch containers used during picnics and other outdoor activities are all useful for the niche problem they address. Through an examination of these products, I hoped to take successful elements of each and apply them to a comprehensive food transportation system.

Jetboil

The main purpose of the Jetboil system is to reduce the amount of time and energy used in heating food and drink. In this way, less energy is needed and consumed throughout the length of a trip. The technology uses an integrated heating unit and vessel that decreases the amount of energy that is lost in between the heat source and heated container as well as limiting the energy lost by using an open or loosely covered container. Once the food or water has been heated, the container used to heat the cuisine can then also be used to eat from. The vessel is then cleaned after each use. (Jetboil.com)

Jetboil possesses some of the aspects that I was trying to feature in a recreational food system. Two aspects that are absent from the system that I would like to incorporate into my project: 1.food is transported in a one container and then transferred into the cooking unit rather than remaining in a single vessel throughout the trip 2.the scraps of food that are not consumed are scattered on the ground during cleaning rather than leaving with the person who brought them in. Although the Jetboil system functions well for its purpose, I wanted my project to have a larger purpose than simply cooking food more efficiently.

Freeze-dried foods

Freeze-dried food products have changed the way many people consume food outdoors. An entire meal is contained in a single package that can be rehydrated in minutes. These one-pot meals are encouraged by the LNT principles as a way to decrease the amount of food waste and packaging that is necessary for an outdoor excursion. The retail cost of these foods is relatively expensive: depending on the brand and amount of food included, the price ranges from $4-$8 per serving. These meals are simple and lightweight but complaints about taste and cost are fairly frequent. (Outside.com, 2004; Tilton, 2003) If recreational users had individual servings of packable meals they prepared at home, it would be more cost effective and more flavorful if they used spices and ingredients they enjoy eating.

Portable Lunch Containers

Transporting snacks and meals in a readily-available container is a regular occurrence: children bring food to school in a lunch pail and outdoor meals are accompanied by picnic baskets. There are thermoses that hold heat or keep food cool throughout the day, and brown paper bags remain the staple symbol for a homemade lunch. It seems appropriate that outdoor recreational activities should have a corresponding item that would serve the purpose of keeping all the foodstuffs in one place. Ultimately, a combination of the one-pot meal, the single container for heating and eating, and a cohesive unit to hold the necessary accoutrements seems like an ideal combination for eating during outdoor recreational activities.

Considered Features

Explorations were fairly productive throughout the development process. There were some directions that received attention while others were barely examined or abandoned altogether. The decision to drop an investigation is made according to the specific item and its relationship and relevance to the project. The following features were closely considered for assimilation into the system. After careful deliberation, each piece was cut from the project for the reasons denoted in each section.

Cooking with Water

Numerous outdoor meals are cooked or rehydrated using hot water. Considering this, I thought about using perforated containers for food items that need to have contact with water in order to be consumed. The holes would be covered during transport so that the food would not spill, and then uncovered during the cooking process. In this way, the water could easily be drained from the container during consumption. The component that covers the perforations during transport could then also cover them when a user is eating.

Although this feature might make the heating process simpler, it would also create more weight because of the extra component needed to cover the holes when they are not in use. Another disadvantage to the colander-like food container would be the extra effort it would take to clean the small holes. I believe that this concept may have future possibilities with further design refinement, but I felt that it was not something that I should use in the development of this specific project.

Self-Heating Unit

During the research and development phases, there were several paths that ended because of an impassible obstacle. One of the most disappointing dead ends was the self-heating cooking unit. By combining both the cooking mechanism and the food storage container, the user would be able to eliminate extra weight and additional pieces of equipment. These reductions are advantageous to most if not all users who bring food into the outdoors.

Fueling the cooking process requires an energy source. Traditional heating units include an open flame fueled by gas, tinder or tablet. In these instances, the heating source is separate from the container the food is transported and consumed in. In my research, I was looking for an energy source that could be integrated with the food storage unit to minimize the amount of space and weight associated with extra equipment.

The most promising product research came from the military with the meals, ready-to-eat (MREs). MREs include a wide range of food products, but the self-heating meal technology seemed as if it could be readily applied to use in the outdoor recreation market. The simplicity of a compact heating unit integrated with food packaging appeared ideal for the purpose of this project.

The technology uses a mixture of powdered food-grade iron, magnesium and salt that when combined with water creates a chemical reaction that heats to approximately 100 degrees Fahrenheit for just over ten minutes. (Heater Meals 2006) The chemical mixture is combined with water in a small bag that is then placed next to the food; ideally in a closed container and on a heat-resistant surface. The heating bag then needs about ten minutes to fully heat the meal.

Another version of the MRE self-heating meal is the "hotcan". These units are self-contained and the chemicals used to heat the food have their own compartment around the exterior of the can. These cans use lime (calcium oxide) and added water to create a chemical reaction rather than the combination of elements that the MREs use. However, the temperature and length of time it takes to heat up food is very similar to the heater meals. The technology in both instances is comparable, but I became concerned about the materials and chemicals that became waste after the product's usefulness expired.

This avenue began with what seemed to be the perfect solution the issues being dealt with in this undertaking. After an in-depth investigation, these one-time-use containers are not a flawless solution as originally thought. The chemicals that heat the units are not toxic, but they are only good for a single use. If a reusable container were to be used, the chemicals would need to be disposed of and replaced for every excursion.

Sectional Containers

Creating a system that reduces food waste is a large topic to tackle. One of the issues that I initially addressed was how to contain the food: what should the container look like and how should it function. I started by looking at ways to reduce the amount of space the product would occupy.

One of the first possibilities that I thought of was separate smaller containers within a larger rectangular case. Each small container would hold food and the large case would reduce in size as food is consumed. To me, this solution seemed conventional and uninventive. The next iteration became individual pie-shaped units that roll up into a single cylindrical element (Fig. 7-1). The major flaw with this concept is that when a pie-shaped element is empty, the circumference of the cylinder will remain the same. A piece of gear should always take up as little space as possible: an element that is empty should take up less space than if it were full. Then I altered the cylindrical concept to extend in a telescoping fashion rather than dividing the interior space into smaller sections (Fig. 7-2). Individual units would collapse into one another after each one has been emptied. The combined units would also connect to an eating container.

Following the initial sketches and sketch models along these lines (Fig. 7-1, 7-2, 7-3), I decided that I should instead be attempting to reduce food waste before I deal with the issue of reducing the weight and space. Outdoor recreation users are almost always concerned with space and weight because he or she is generally carrying everything. I became focused on a problem that is presently addressed in outdoor gear instead of being concerned with the problem that I had set before myself.

The concept of sectional containers for use in outdoor gear may have future potential, but not for this project and its specific purpose. In an effort to reduce food waste during an outdoor excursion, I began to look at the food container as a single entity rather than a series of objects including plastic bags, cooking pots, eating containers and trash bags. Every time food is transferred to another vessel, it creates another surface that must be cleaned or disposed of properly. Considering the problem more thoroughly, I decided that part of the project would be to design a system where food is not transferred from one container to the next. Instead, I would design a product that would allow the user to transport, cook, eat and clean the food with a single container. In this way, food waste would be reduced because fewer surfaces need to be cleaned and no exchanges are made, eliminating the chance of food falling during the transfer.

Fig. 7-1 Pie piece food container

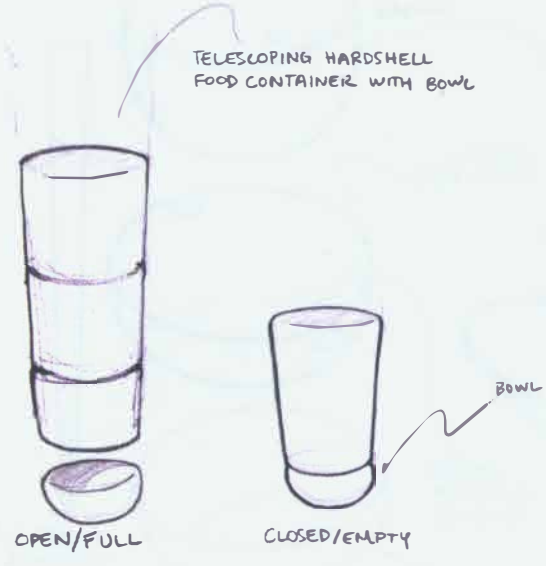


Fig. 7-2 Telescoping food container

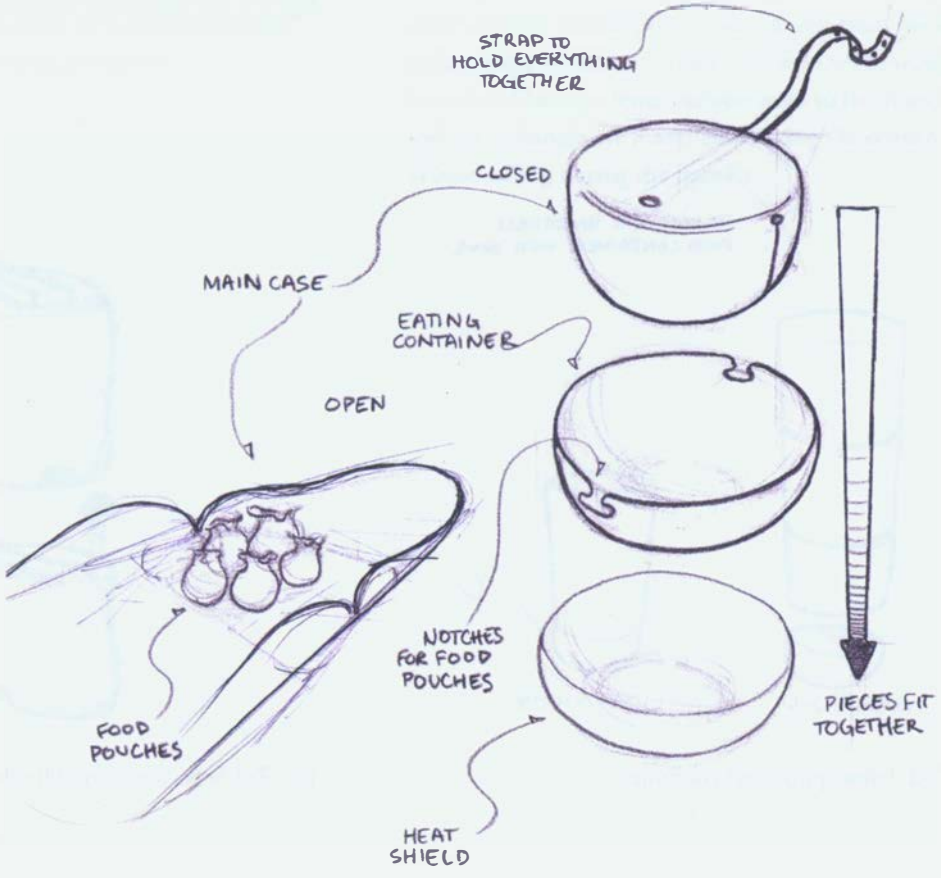
Fig. 7-3 Soft, connecting food containers

Integrated Food Transport System

From the beginning of the project, I wanted the outcome to be a cohesive and practical product; something with a solid conceptual base that could be used in real world situations. As the research and development progressed, the path became more palpable and clear. By acknowledging and learning from the missteps along the way I was able to develop something inventive and practical. The system that emerged includes several different elements that address specific issues of food transportation during outdoor recreational activities. These components include a main case, food bag, eating container, flame shield, and snack container. (Fig. 8-1)

Each of these elements is included for specific reasons; expanded explanations for their inclusion can be found under the individual sections. In brief, the main container is used to hold in a space-efficient manner and also provides a working surface for food preparation. The food bag is a vessel capable of accommodating food throughout the length of its journey, including transportation, cooking, eating and disposal. An eating container holds the food bag during consumption of food. Initially, the eating container provided support for the food bag but when the flame shield took over that responsibility, it became a protective layer between the user and the heat of the flame shield. The flame shield protects the food bag from direct contact with fire during cooking and also provides support for the bag during consumption. The snack container was not originally included among the individual elements. It was a later addition because of the result in the development of the food bag.

Fig. 8-1 Preliminary comprehensive food transport system



Target User

The target user is fairly broad for the proposed product system in hopes that it will be useful for several recreation markets. The primary activities that the system would be used for are hiking, camping, fishing, and canoeing. Originally I had thought of the product as something to be used for hiking and camping trips. After some investigation into the sporting goods industry, I realized that I was excluding a large part of the market. The users would generally be participating in light to moderate activity and would be aged from teenager to adult. Both men and women are included as target users for this product.

A typical user would pack the necessary food items at home and consume the food outdoors. Once the food is packed, the system would then be placed inside a backpack, tote bag or other storage device depending on user preference and the strenuousness of the activity. Each food bag would be taken out of the system in order to consume the food, then the empty bag would be placed back into the system until the user goes back home. Once the user is home, the entire system can be disassembled for cleaning and reuse.

Food Bag

The exploration of the sectional containers directly influenced the development of the food bag. As previously mentioned, a shift occurred in my approach to the problem: instead of focusing on the entire system, I would develop the project by concentrating on the element that is most intimately connected to the food itself. I decided that the food should remain in a single container throughout the length of an excursion. In this way, there would be fewer surfaces to clean after each use and there would be fewer container transfers and therefore fewer opportunities for food to fall on the ground.

Choosing a material to use for the food bag was relatively easy. The material needed to have specific characteristics in order to fulfill its purpose and there are a limited number of substances that could satisfy these requirements. The bag needed to be durable, portable, withstand cooking temperatures, and can be easily cleaned. Food-grade silicone possesses all of these attributes. The silicone is heat resistant up to 500 degrees Fahrenheit, provides a non-stick surface, and is dishwasher safe.

The nature of the material is very flexible and somewhat slippery, making a closing mechanism fairly difficult to design. Early in the food bag exploration, it became clear that the method of closure would be a difficult obstacle to tackle. The early versions were designed with loops and tabs in anticipation of folding the silicone over itself to seal the bag. (Fig. 9-1) The folding method did not produce the desired results. When the silicone was folded once, the seal was not airtight and would therefore cause problems with spilling the contents. If the silicone was folded twice or three times, the closure was tight enough, but the amount of silicone that was used in the closure was excessive; there was too much material that could not be used to hold food.

Fig. 9-1 Initial sketches of the food bag

Fig. 10-1 Food bag closure: external clip

Fig. 10-2 Food bag closure: stopper and plastic-coated wire

The next approach I tried was to combine the folding method with various clips. (Fig. 10-1) A major drawback with this approach is that the clip is something separate from the bag and would be small enough so that it could easily be misplaced. I then turned to a concept using a plastic-coated wire, a cinching mechanism, and a rubber stopper. (Fig. 10-2) The stopper is inserted into the opening of the bag while the wire wraps around the outside and is then tightened around the stopper to form a tight closure. As with the previous solution, the wire-stopper method uses an extra piece that could easily be misplaced. After several user trials, it became clear that this method was also very difficult to execute properly. As a result, this means of closure was discarded as well.

Ultimately, I chose to use a slider zipper, which is well-known as the Ziplock® closure, to seal the food bag. This decision was made because the mechanism is easy to use, has no extra parts, is able to stand up to heat and cold, and can produce an airtight closure. I analyzed its ability to stand up to heat and cold through a series of trials in the microwave and the freezer. Even the generic brands were as reliable at the end as they were in the beginning.

One major disadvantage of using the slide zipper as the closing mechanism is that it cannot be made using silicone. In order for the closer to be manufactured, a different polymer would need to be bonded to the silicone. This step in the manufacturing process is difficult and would therefore increase the cost of the silicone bag. (Specialty Silicone Fabricators, 2008) Even though the slider zipper may not be the perfect solution for this problem, it functions well and serves its purpose.

In addition to the closure, there were several other problems that arose as a result of the chosen material and the stages it needed to go through on an expedition. I am anticipating that the bags will generally be heated up over a camp stove. Silicone is able to withstand high temperatures, but it will degrade fairly rapidly if it is exposed to direct heat. Therefore, the heat shield, which will be discussed in a later section, became a necessary component to the project. Silicone is also not very good at distributing heat evenly; higher temperatures are concentrated around the heat source. This problem was solved by adding several elements to the food bag: integrated flexible aluminum, the heat shield, and a large nodule extending inward from the base of the bag.

The flexible aluminum strips are imbedded in the silicone sides and extend down to the base so they have contact with the heat shield. (Fig. 11-1) In the final design, the flexible food bag is supported by reinforced silicone ribs so that it is a freestanding component. (Fig. 11-3) The thin aluminum runs along these braces to aid with both the structural support and with heat distribution. The heat shield is also composed of aluminum. The shield covers the bottom of the bag and echoes the shape of the bag, forming a central node to distribute the heat along the interior. The top of the central node of the food bag also has a thermo chromatic indicator that changes colors, which signify different temperatures. This feature is useful for determining when the food may be finished cooking.

Fig. 11-1 Food bag with aluminum strips

Fig. 11-2 Food bag with structural support

Fig. 11-3 Food bag with aluminum, stuctural ribs and closure

Once the food has been prepared over the heat, the bag and the attached flame shield are then placed into the eating container. (Fig. 12-1) The flame shield provides a rigid surface for eating while the eating container protects the user from the heat of the bag and the shield. Once the food has been consumed, the bag is separated from the eating container and the flame shield, closed, and put back in the main case. If there are food remains after eating, the cleaning should be saved for home because then the leftovers are being disposed of in the trash or compost rather than the outdoors.

Portion control is also an important feature for Gitanos. Although the food bag currently has one size, there would be three available sizes in a retails setting: small, medium, and large. The small bags would hold enough food for one meal; the medium size would hold up to two portions, while the large bag would hold up to four portions. The different sized bags would be very helpful for meal planning. Determining the amount of food that a single person should take on a trip can sometimes be difficult. The instructions for Gitanos would include a small section on determining portions according to the user and the size of the food bag.

The final design of the food bag has a slider zipper for closure, silicone ribs for support, embedded aluminum and a central nodule for heat distribution, and a thermo chromatic indicator for more accurate cooking. The bag closes easily, is packable, can hold a meal throughout a trip, is easily cleaned, and is reusable.

Fig. 12-1 Diagram of the food bag, flame shield and eating container

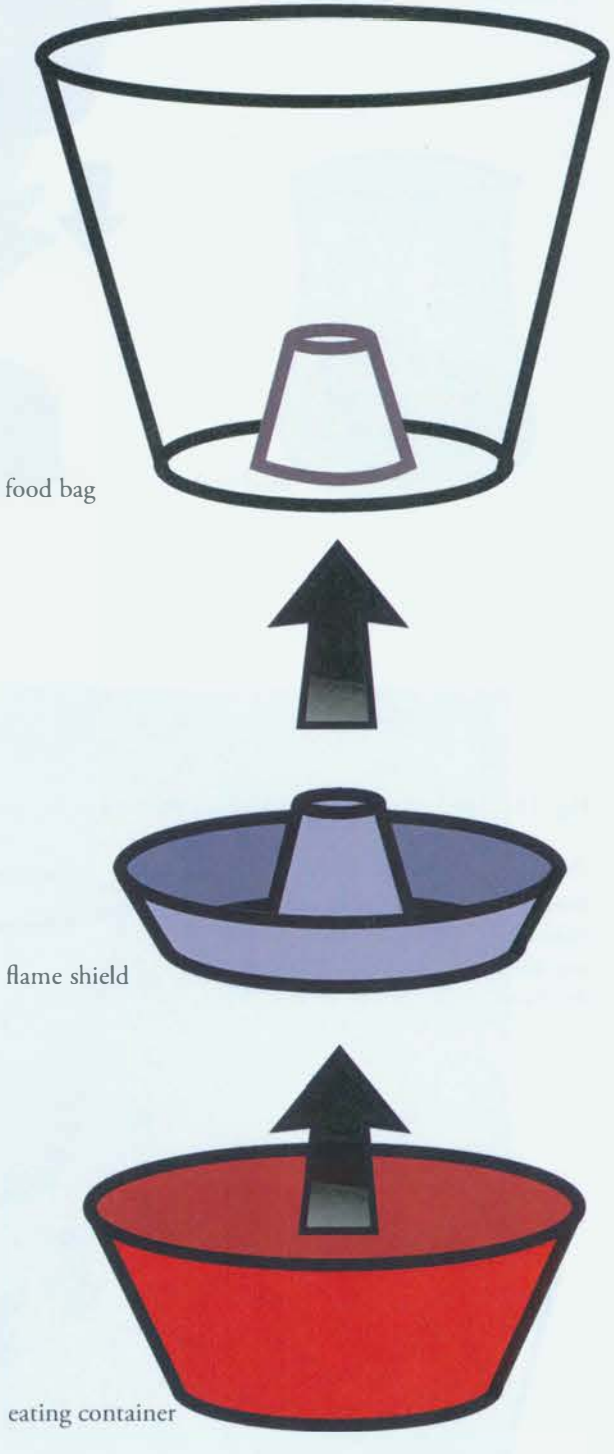


Fig. 13-1 Diagram of traditional cooking method

The traditional cooking method requires the transfer of food from one container to another.

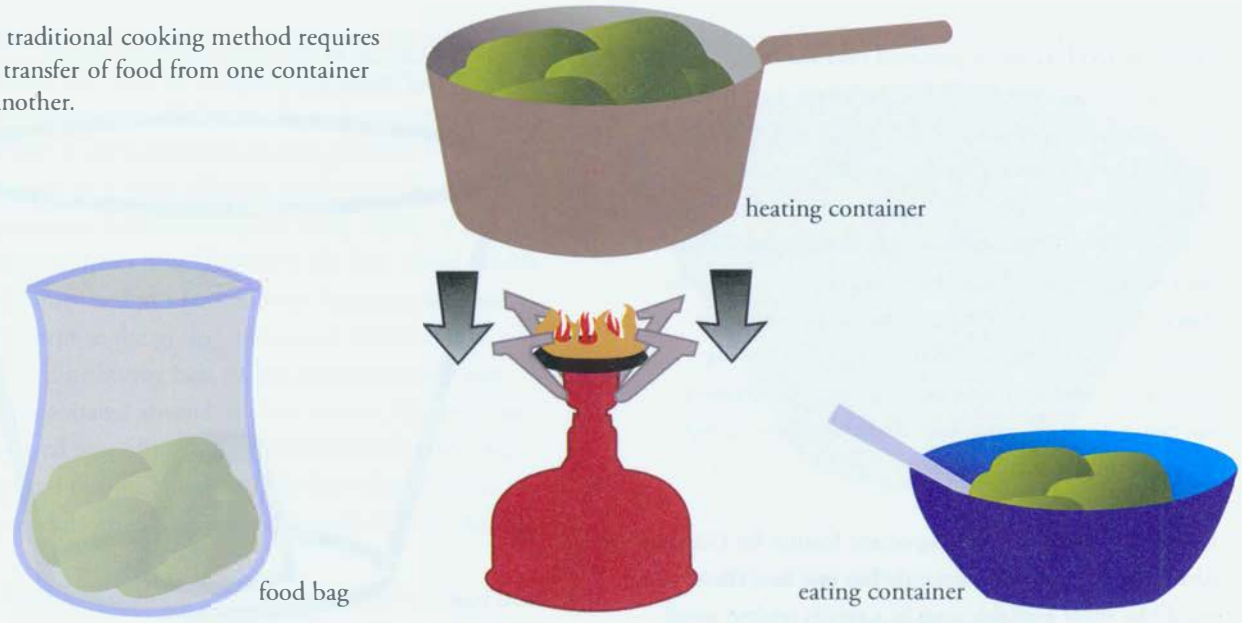
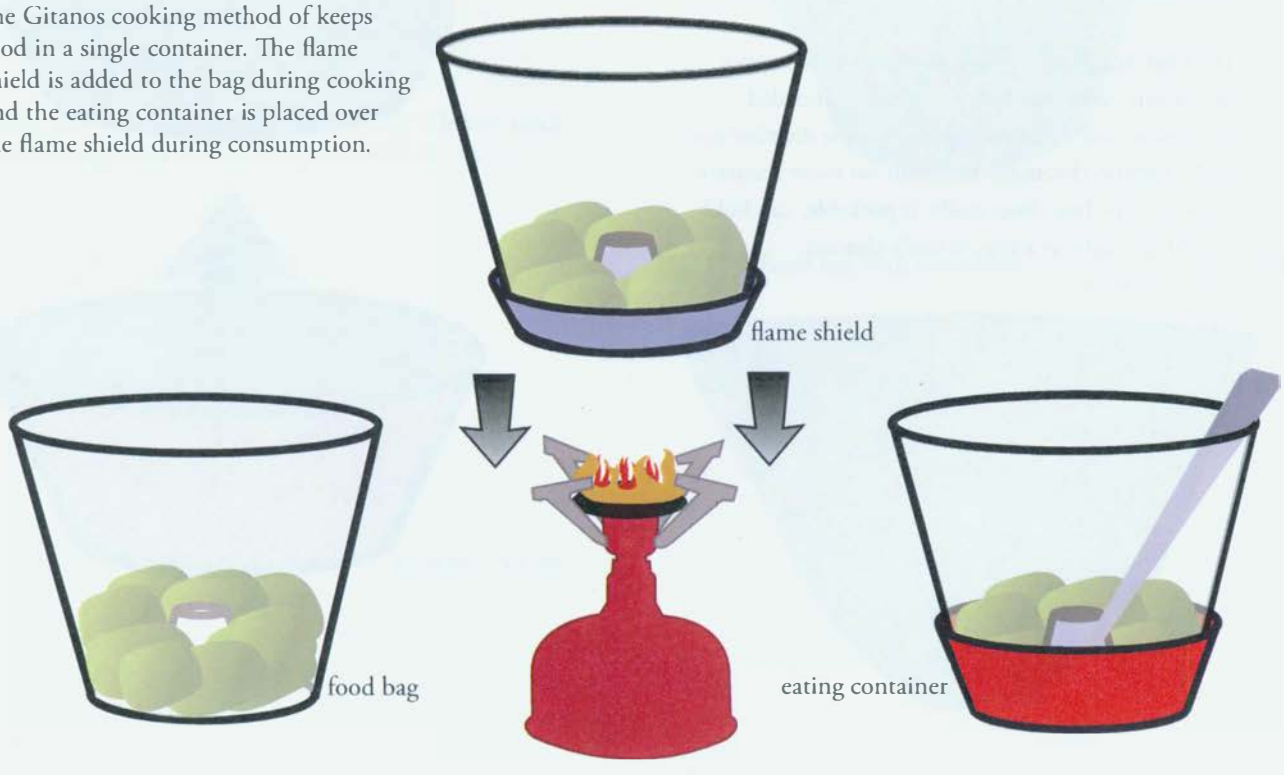


Fig. 13-2 Diagram of Gitanos cooking method

The Gitanos cooking method of keeps food in a single container. The flame shield is added to the bag during cooking and the eating container is placed over the flame shield during consumption.



Final Food Bag Design

Fig. 14-1 Side image of final food bag design

Fig. 14-2 Top image of final food bag design

Main Case

The main case was the first part of the system to be explored because it seemed appropriate to start with the element that would hold everything else. The sectional containers, which have been mentioned in a previous portion of the paper, were the beginning stages of this development. The sectional containers were deemed inappropriate for use in the project, so I continued to develop the case in according to different objective.

The main container should be capable of holding all of the items in the system. It should also occupy a minimum amount of space and provide a useful surface on which to prepare meals. Based on these guidelines, I began to develop the main case alongside the other elements in the system.

The new line of sketch models (Fig. 15-1, Fig. 15-2) was composed of stretchy material so that there would be no wasted space. Some of the iterations folded in on themselves to reduce the amount of space further. The closures ranged from magnets, to button and loop, and even simple friction. Compared to the final design, these preliminary versions are more complex in concept but less practical for outdoor use. Except for the versions using friction, the closing mechanisms were too complicated for use during recreational activities. The stretchy material was somewhat unnecessary because regular fabric could simply be folded over or rolled up.

Fig. 15-1 Sketch model of collapsible main case

Fig. 15-2 Sketch model of clamshell main case

The series of sketch models that lead to the final design became about creating a working surface and holding the other elements of the system. (Fig. 15-4)

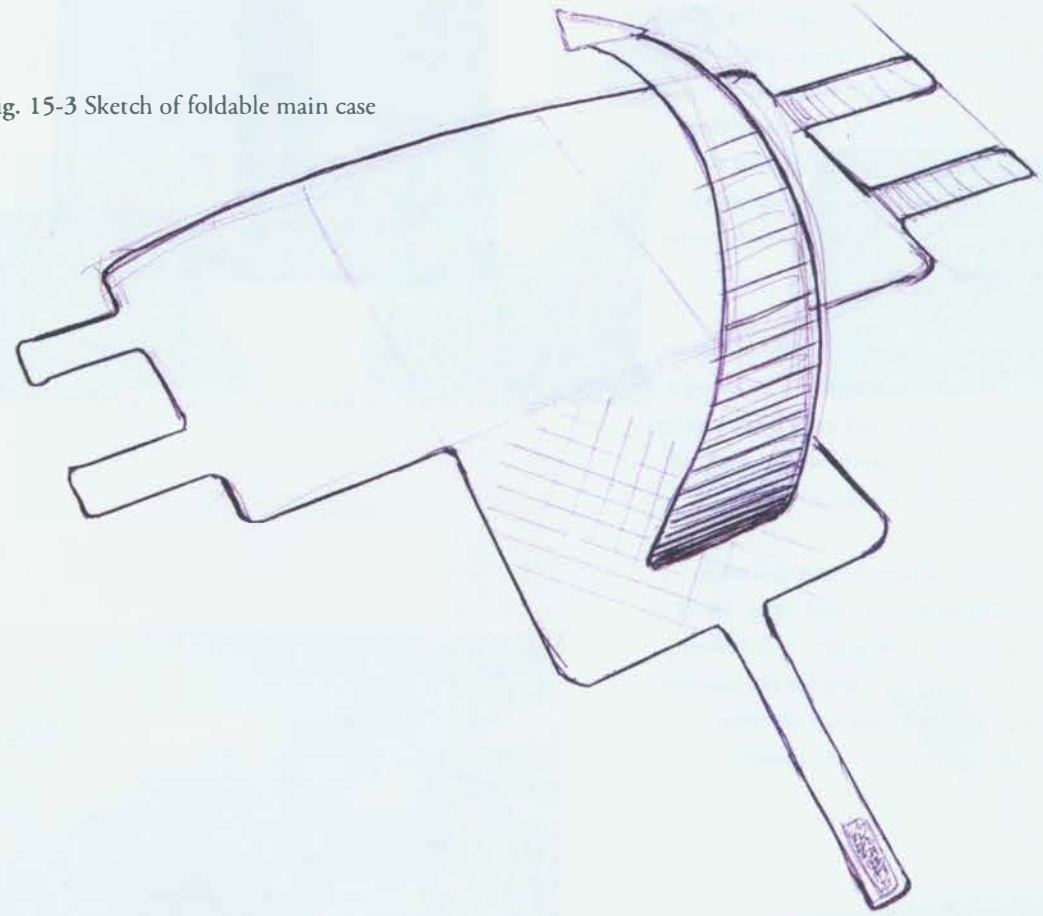


Fig. 15-3 Sketch of foldable main case

Fig. 15-4 Sketch model of foldable main case

The final design for the main case consists of three main parts: the zippered protective covering, a mesh bag, and a flexible cutting board. The outside cover is made from a rip-resistant, durable material with a heavy-duty zipper around the exterior. The cover can be completely unzipped so that it can be used as a working surface. (Fig. 16-3) The mesh bag is attached to the cover with a strip of hook and loop. The mesh bag also has a heavy-duty zipper running down its length. (Fig. 16-1) The flexible cutting board provides a more rigid surface for preparing food. The cutting board is attached to the cover by strips of webbing with hook and loop that are threaded through small slots in the sides. (Fig. 16-3) Both the mesh bag and the cutting board are removable so that they can be cleaned and the cover can be washed in the laundry.

The main case is practical for outdoor use and is easy to clean. Each part is removable so that once it is brought home, it can be easily taken apart and each piece can be cleaned. The case also provides a useful way to keep all food and most cooking gear in one place.

In a retail setting, the entire system is wrapped with a single strip of paper displaying the label. (**Fig. 16-5**) The name, Gitanos ("gypsies" in Spanish), is followed by the statement, "take your food along for the journey." (**Fig. 16-2**) I wanted a name that was not obvious to everyone but was also pertinent to the project.

Fig. 16-1 Internal mesh bag

Fig. 16-2 Retail packaging for Gitanos food system

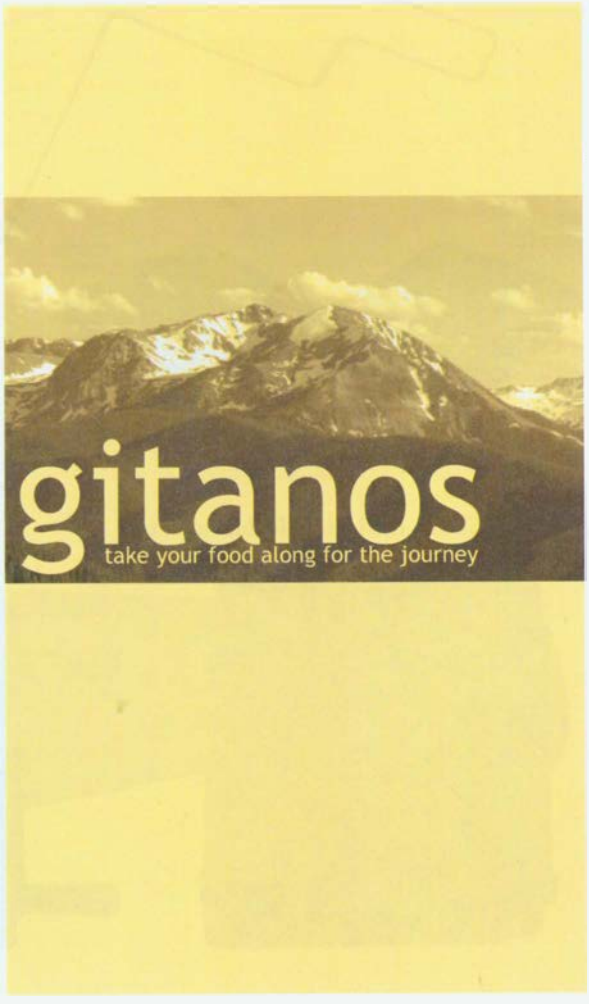


Fig. 16-3 Process of opening the main case and separating the elements. The main case can open flat to provide a working surface. The flexible cutting board and the mesh bag can be removed to create a working space and clean easily.

Final Main Case Design

Fig. 16-4 Opened main case showing the cutting mat and mesh bag

Fig. 16-5 Product shown with retail packaging

Fig. 16-6 Product shown closed and in use

Flame Shield

The flame shield became necessary when the silicone food container was selected to accomplish the objectives of the project. The shield protects the food bag from the direct flame of a fire or camp stove and also provides a rigid surface for cooking and eating. The development of this element progressed in direct relationship with the food bag. As a result, with each iteration of the food bag came a new version of the flame shield. (Fig. 17-1)

Fig. 17-1 Two iterations of the flame shield

The final design for the aluminum flame shield is simple in shape and practical in purpose. (Fig. 17-2) The center node permits for more surface area for heat distribution within the bag. The flat bottom and slightly raised sides allow the bag to be placed on a stove and protects the bag from any stray flames. Camp stove flames are generally concentrated in a two to three in diameter so the bottom of the silicone bag will be protected. The flame shield should not be left on a heat source by itself because camp stoves can become very hot (over 1100 degrees Fahrenheit) and the heat needs to be transferred to food or water (Mountain Safety Research, 2007). Quality testing would need to be conducted to determine the appropriate thickness of the aluminum. Although no food will be in contact with the aluminum, it is easy to clean and is reusable. The flame shield comes in one size that will fit the bottom of the small, medium and large size food bags.

Fig. 17-2 Flame shield integration with food bag

Eating Container

Originally, the eating container was developed alongside the food bag as a way to make the bag more rigid when a user is eating. Trying to stab a fork at the bottom of a silicone bag is not very productive. The design explorations for this container focused on collapsible objects that would support the food bag during consumption. I examined methods of expansion and retraction as well as combinations of soft and hard materials. (Fig. 18-1, 18-2, 18-3, 18-4)

Fig. 18-1 Collapsing eating container

Fig. 18-2 Supportive frame for food bag

Fig. 18-3 Combination of hard and soft materials in collapsible eating container

Fig. 18-4 Combination of hard and soft materials in collapsible eating container

As the project progressed, a feasible solution revealed itself: a simple three-armed plastic structure that rotates around an axis and provides external structure for the food bag. (Fig. 18-5) The object has clean lines, is easy to use and takes up a small amount of space. However, one major problem arose during a product demonstration: when a user takes the food bag off the heating unit, the flame shield is still attached. The plastic eating container cannot be placed onto the food bag without first removing the hot shield. A different direction was necessary for the final design.

Fig. 18-5 Eating container integrated with food bag

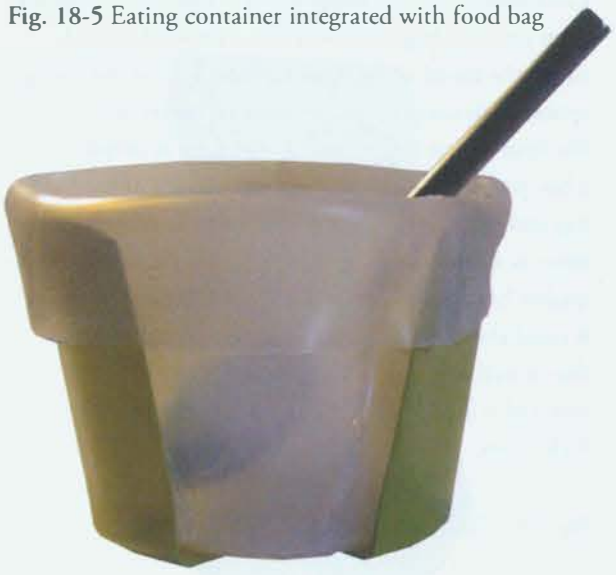


Fig. 18-6 Hard, collapsible eating container

Final Eating Container Design

Considering that the flame shield is difficult to separate from the food bag while it is hot, I decided instead to use the shield as the rigid support and use the eating container to simply protect the user from its heat. The final design for the eating container is simple: a hot pad sleeve that slips over the bottom of the food bag and the flame shield. (Fig. 19-1) The material is the same as a professional-grade oven mitt. Currently, high-quality hand protection used in commercial kitchens is rated above 400 degrees Fahrenheit, a temperature that is well above the cooling bag and shield. The material is flexible, lightweight, and takes up very little room.

Fig. 19-1 Soft and packable eating container

Snack Container

The concept of the snack container was not originally part of the product system. As the food bag was developed, something to hold snacks became essential because not all of the food needs to be cooked. Therefore, carrying the entire food supply in silicone food bags creates more weight and wastes space.

The purpose of the snack container is to provide an alternative to the food bag for transporting snacks and non-cooked foods. Snacks are sometimes consumed on the go, so I also wanted the container to be easily accessible during the trip. The object should also be small and lightweight. Initial models for the snack container were mini systems that included designs of both the bag and its holder. (Fig. 20-1) The external sheath has a loop on the back so it can be attached to a strap or a pack. The internal plastic bag has an opening made from two stiff pieces of plastic, which can be opened and closed by squeezing on the sides. The plastic bag could be cleaned and reused, but would have a limited life cycle. Although creating a product where one of the elements is continually being replaced creates more revenue, to me it is a fairly narrow-minded approach. A design like this does not allow consumers to use their own plastic bags. The concept was reconsidered and a slightly different path was taken from this point out.

Fig. 20-1 Plastic snack bag and holder

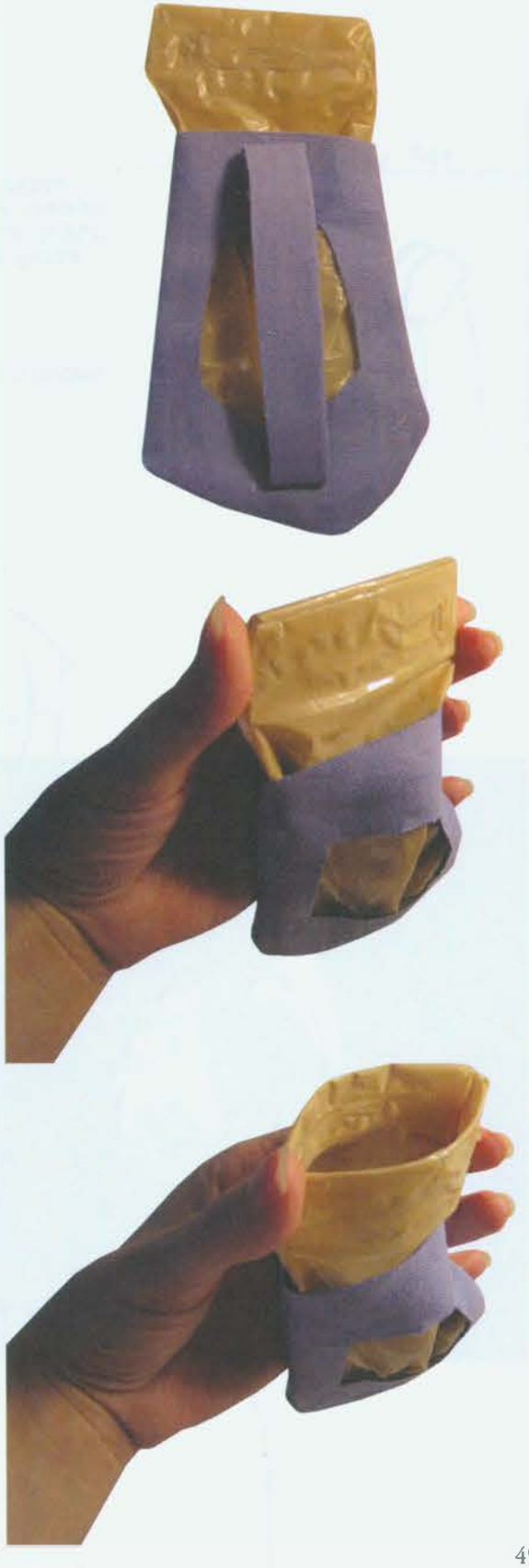
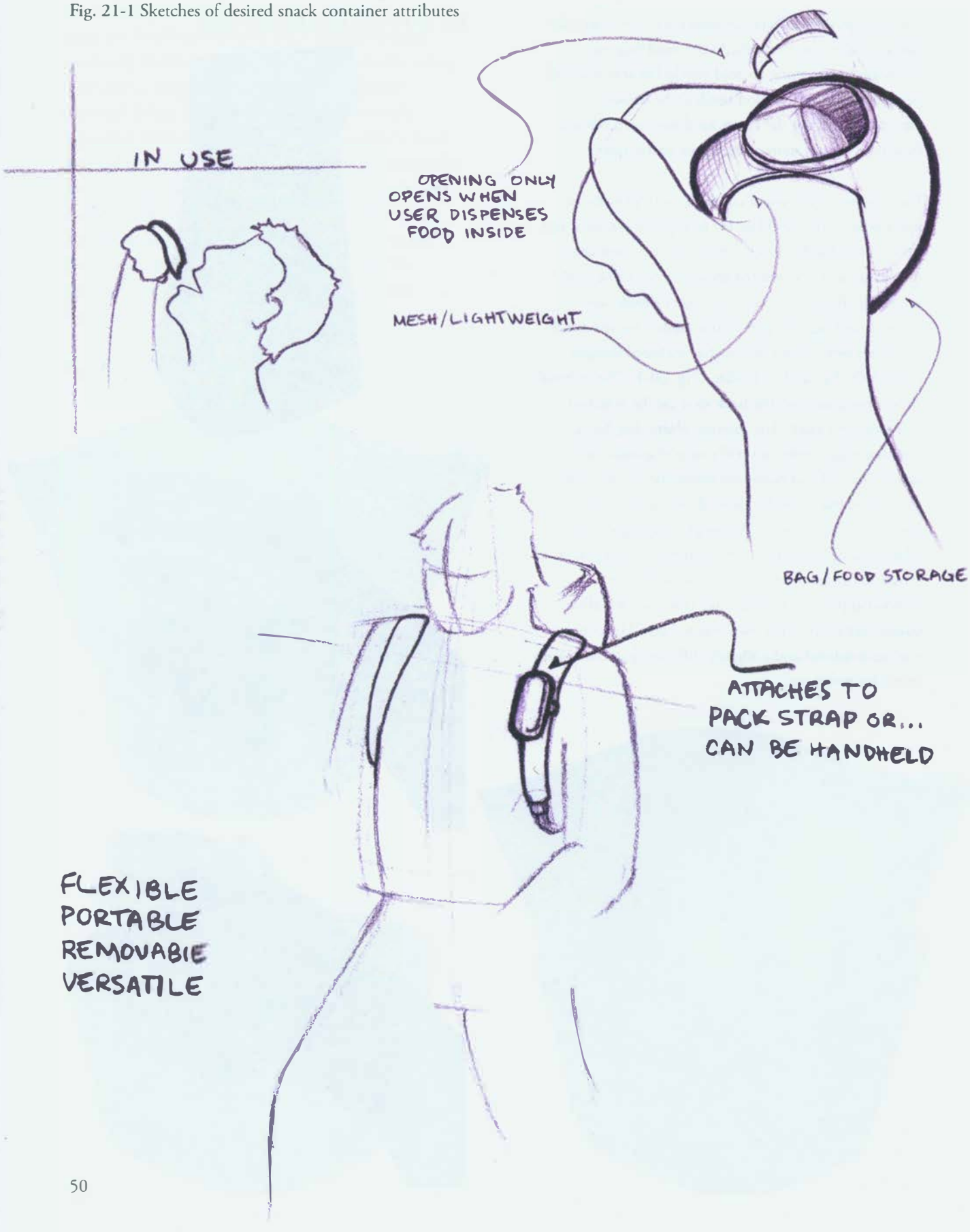


Fig. 21-1 Sketches of desired snack container attributes



The top of the plastic bag in the mini system inspired the final design for the snack container. (Fig. 22-2) Instead of integrating the squeezable opening with the plastic bag, it became the basis for the snack container. The rigid plastic is wrapped with webbing, has a loop for attaching it with a carbineer, and has two clips to hold any plastic bag. I had thought about using a single clip spanning the length of the object, but because the container needs to flex in order to open, I decided to use one clip on each end. Any sized plastic bag can be used with the snack container. (Fig. 22-3) This item makes snacks easily available to the user. (Fig. 22-1) It also reduces the need to reach inside a bag because the bag can be opened and poured directly into the mouth.

Fig. 22-1 Final snack container in use

Final Snack Container Design

Fig. 22-2 Front of snack container with clips

Fig. 22-3 Back of snack container with loop for attaching to pack/clothes/etc. (carbineer not included)

Fig. 22-4 Snack container in use with bag

Final System Design

The complete system is composed of the main case, which holds all the other items, a food bag, which holds food during transportation, cooking and eating, a flame shield that protects the silicone food bag during cooking and also provides rigid support during consumption, an eating container that protects the user from the heat of the bag and the shield when eating, and a snack container, which holds snack bags and can be stored in the main case or attached to an external strap for better accessibility. In my opinion, the assembled elements form a cohesive system that helps the user spill less food, clean fewer surfaces while outdoors, and eliminate the transfer of food from one container to another.

Fig. 23-1 Illustration of final system elements

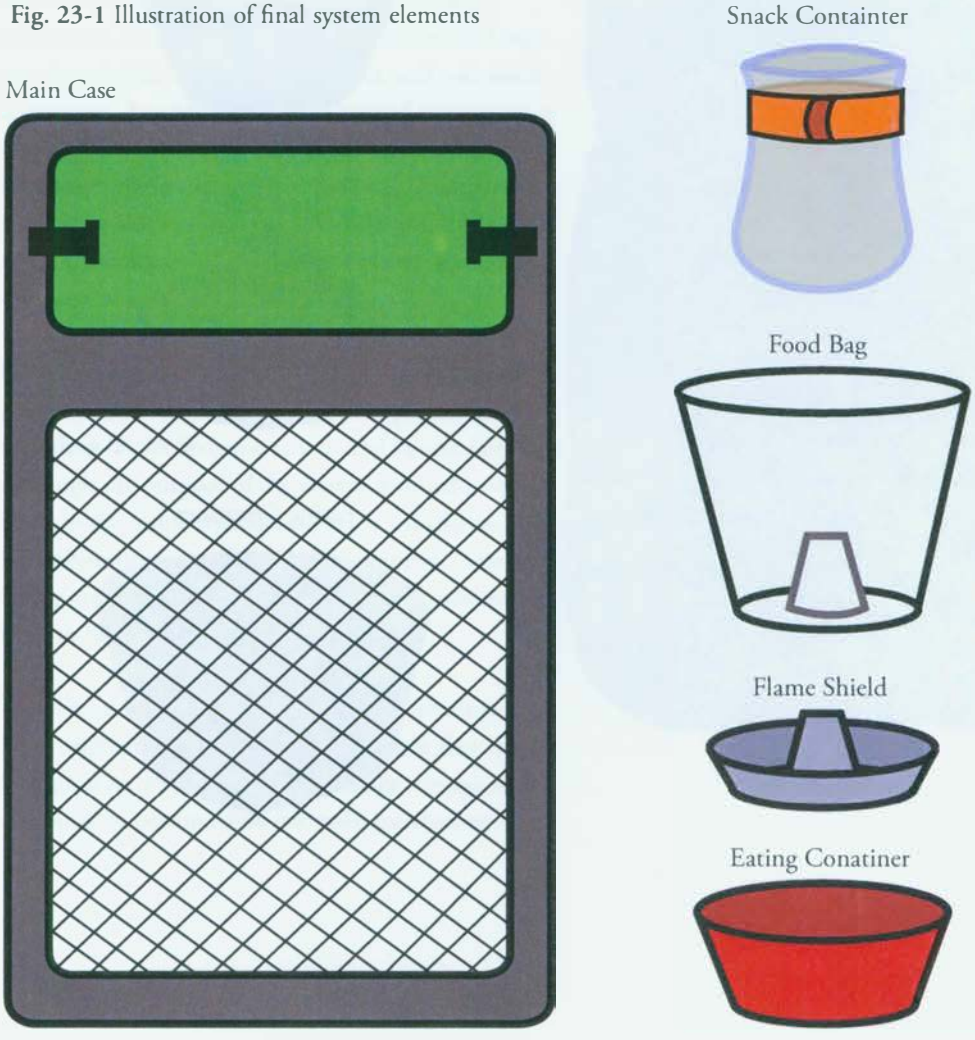


Fig. 23-2 Final components of Gitanos

Main Case

Snack Containter

Food Bag

Flame Shield

Eating Conatiner

Conclusion/Assessment

The main objective of this project was to create a product that inherently encourages outdoor users to abide by the Leave No Trace principles. I believe that by creating a system that reduces the number of opportunities that food may be spilled or disposed of on the ground, accomplishes my original goal. A future possibility to extend the relationship between LNT and Gitanos would be to develop a cookbook with one-pot meal ideas. According to the LNT ethics, one-pot meals are a great way to reduce packaging and food waste. These recipes would maximize the features of the food bag and its versatile nature. Pasta, oatmeal, and soup are all simple meals that could easily be made with this system. If a consumer owned a dehydrator, creating personal dehydrated meals would be much cheaper than purchasing a pre-made freeze-dried package.

The items that are included in the retail package of Gitanos are the main case, one medium food bag, one heat shield, one eating container, and two snack containers. Any additional food bags of any size must be purchased separately. The heat shield and eating container will fit on any sized food bag. I anticipate the price point to range from $90-$120 considering relatively comparable retail products and depending on material and labor costs.

Gitanos has potential to be sold at smaller sporting goods retailers as well as the larger corporations including Dick's Sporting Goods and Sports Authority. Although the purpose of the system is to reduce food waste in the outdoors, the product is a useful tool even if its objective is not clear to all consumers. Gitanos is easy and fun to use, and easy to clean…who wouldn't want to buy it?

The process did not produce the type of product I had originally envisioned. I had thought that the final product would be a revolutionary concept that any outdoor person could not resist purchasing. Gitanos is not a radically innovative product; instead, it is the result of thoughtful decisions and assessment of its usability in practical situations. Realistically, this project is not at its end. Although I was able to reach a stopping point, there are still many steps that need to be taken in order for Gitanos to go into production. Field testing, material durability, and ease of use still need to be thoroughly examined. I would be excited for a chance to bring this product to the market and see how something I created could make a difference on the human impact on the environment.

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