Human-Centric Homestead Design

Over the course of a year, a new homestead and community can change substantially. Not all solutions in this presentation can be applied, but the intent and design thinking remains the same: continual progress towards the primary goals that we set forth. This principle of kaizen and iteration is one of the most important concepts when creating something as new and different as a project like Permala.

These are the notes and slides from a final presentation given at the end of 6 months of research and protracted observation to both community members and visitors who were interested to see the designs and hear about the relevant concepts. Each page constitutes one slide and the information I delivered.

Permala Human-Centric+Permacultural Design

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Entrepreneur

I am Scott Church, a human-centric designer for technology, landscapes, and lifestyles. Safety, efficiency, and enjoyment are the primary goals of my work. The Air Force trained me as an Intelligence Officer to think about problems as part of a whole, and consider the entire system when solving them. I now apply this strategic thinking to my studies in human factors and permaculture. I am an environmentalist, and I believe that good design just might save the world.

This presentation sums up our process and design ideas going forward for anybody interested in learning about human factors, permaculture, or how they can effectively guide a design process.

Why are we doing this?

The Golden Circle + Human Brain

https://www.ted.com/talks/simon_sinek_how_great_leaders_inspire_action?language=en

- ▶ WHY - HOW - WHAT
- ▶ THRIVE - GROW - DAILY TASKS

- ▶ Requirements:
- ▶ Grow businesses
- ▶ Grow food
- ▶ Grow community
- ▶ Embrace good design!

When we started, we had some ideas of what Permala could be, with some very broad goals, which we turned into requirements, and which form the basis of our designs. It is very important to understand the thought processes behind these before presenting the eventual solutions we devised.

Neurobiologists believe the three structures of the brain correspond to goal setting and motivation. The most basic structures that likely evolved first are the limbic systems. These are part of where our strongest feelings come from, but they have little to no language processing ability. We cannot fully express how it feels when our actions are deeply aligned with our goals, but if we are doing something that feels "right," we just know it. This feeling can be enhanced with trust and safety, which is also essential to the community. These limbic systems correspond with our "Why." In short words, Permala exists to help members thrive, grow, and accomplish right-livelihood, or feeling good about what we are doing. We will grow food, grow our community, and always remember we are part of a greater design - that of nature itself.

**Why bother with a design?
Requirements for the design itself.**

- ▶ Get all residents/Permaliens on the same page
- ▶ Coordinate efforts towards common goals
    - ▶ "Many hands make the work light" - Compost
- ▶ Establish shared understanding of environment
    - ▶ What belongs where - tools, plants (weeds)
- ▶ Decision making framework
    - ▶ Faster, reduce stress
- ▶ Improve efficiency/human effectiveness
    - ▶ Decrease wasted effort/duplication of tasks

We need to get everybody, even new people who come in, operating in the same fashion so that we do not inadvertently work against each other or squander resources. This goes beyond closing doors, although self-closing doors are one potential way to help reduce energy usage.

While we seek simplicity, we acknowledge that communities and life systems are complex, and require a high degree of collaboration. We will need to create tools to enhance our communication and planning.

Designing for the requirements of the community actually requires a design for the design. This lets us know what elements we will be incorporating to meet the high level requirements of growing the business, growing food, and growing the community.

What we call a "mental model" is really just an understanding of the workings of something. If we can all share the same model, we will have multiple places to avert failure, like the loss of a tool, or what plant is a weed and needs to be pulled (or not).

A good design can help us make decisions faster. Establishing a thought-out framework for how to reach consensus keeps things low stress and allows us to move forward with less friction between people.

This drive will help us meet the requirements we set forth: to grow the business, grow food, and grow our community. Good design, baking in trust by ensuring easy and less stressful communication, easier work, and a more comfortable space where we embrace abundance instead of scarcity will help with this.

This design will also need to be based on what currently exists because we are not starting from scratch. The community already has some infrastructure that must be acknowledged before moving forward with the design. These can be called "Constraints."

Setting

- Located in Montgomery, Alabama
- Group of 4-5 residents living in 3 bedroom house
- Access to 1.75 acres of land
- Budget based on small hospitality business (~$250/month)

Our geographic location informs our climate and our proximity to a city determines the kinds of local businesses that can help us, by giving us their food waste for our chickens or black soldier flies.

The number of people that live in the house will help us determine our energy and resource consumption, also letting us set goals for reduction.
The house size for this number of people will probably use 10-50kWh a day, depending on the weather. This can be reduced by going solar or considering other ways to maintain comfortable temperatures in the house.

We have access to nearly 2 acres - this gives us space to garden, play, and establish outdoor sanctuaries for mental heath outside the house: a proven need for communities, even of like-minded people.

The business model already established covers the cost of current utility usage and provides about $250/month that can be reinvested to aid in our goals.

Who is involved? – Stakeholders and users

- Community will fluctuate
- Like minded folks
  - Ecologically interested
  - Fiscally conservative
  - Right livelihood
  - Different levels of fitness
  - Accommodate as many as possible
- Neighbors
  - Need more information
- City
  - Regulations
  - Utilities
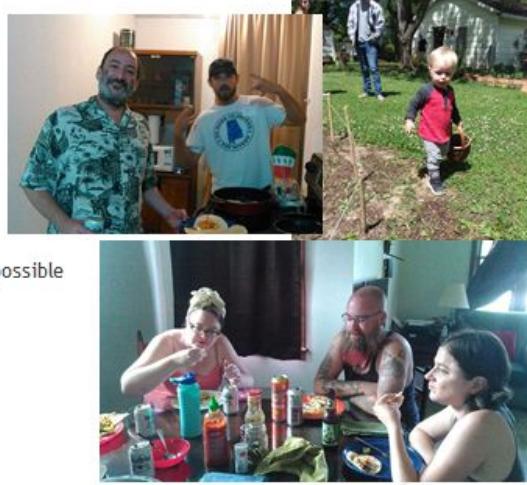
More than ever, a community deserves a human-centric approach. Our "user," is really a resident, The user must be deeply considered for a successful design. Permala attracts diverse groups of people, but there are a few shared traits for our residents. Ecologically interested, careful with money and resources, people who are seeking to make their way in the world doing what we call "right livelihood" which means making a living doing what we see as good in the world.

That said, we are not the only people who will be affected by our design, and we must take into account the other stakeholders. The neighbors must be taken into account because our placement of infrastructure, plants, and animals will affect them and we want to promote positive relationships.

The city bureaucracy must also be considered when we are building because code enforcement officers do exist and may make visits when people start seeing strange apparatus in our yards.

Requirements - Our Why

► **Vision:** Create an abundance of resources to exceed humans need by working with nature and each other.
► **Mission:** work together to build resilient, sustainable connections between humans and nature, increasing overall good.
► Requirements:
  ► Grow business
    ► Art, designs, products
  ► Grow food - minimal (if any) need to buy produce
    ► Demonstration
  ► Minimize waste (energetic, material)
  ► Social harmony
    ► Get along
    ► Have fun
  ► Connect with outside community

So, what do Permaliens really want and need? This is what we decided in our early meetings:

We want to be able to grow our business, which means creating products we can sell to branch out beyond our hospitality business. We need facilities and materials to make art. If we have a good enough design, we may be able to sell it. We can also manufacture products, such as soap, herbal tinctures, smudge sticks - these all require crafting space.

FOOD! Food is a big part of homesteading. Growing it offers possibilities of moving to farmers' markets and creating value-added products such as honey or jams. Growing food is also closely related to growing the community with outreach - giving garden tours, and hosting people to show that is possible to reduce the ecological human footprint while increasing the abundance.

These requirements guide our design decisions, as do some schools of thought.

What are human factors?
What is human factors design?

- Placing human at center of system
- Ergonomics - the way the body works
- Cognitive processes
- Sensory processing
- Safety - minimize but accept human error - redundant systems
- Minimize training

- Make things easier, safer, and more fun

Human factors designers seek to build systems around people to promote safety, efficiency, and enjoyment. We consider human senses, ergonomics, and vast bodies of research about human interaction with tools and machines as we design. The process is iterative, meaning no design is final because designers must always seek and respond to feedback from users. The users, here, are the people at the homestead, and the system is the community as a whole. This includes the house, the yard, the garden, the tools, and even the animals.

If we can do things like reduce cognitive load, enhance our pleasant sensory experiences, and ensure we will still have live chickens and plants even if we make a mistake or forget something, the community will feel more stable and more safe. Also more fun, with less to worry about! With good design, a new member, guest, or visitor will be able to operate some of these systems with minimal effort and training, making it easier to onboard as the community grows.

What is permaculture?
What is permaculture design?

- ► Places people at the center of natural systems
- ► Design home and work to accommodate people
- ► 12 Principles: Observe and Interact
- ► Catch and Store Energy
- ► Obtain a yield
- ► Apply Self Regulation and Accept Feedback
- ► Use and Value Renewable Resources and Services
- ► Produce No Waste
- ► Design From Patterns to Details
- ► Integrate Rather Than Segregate Use Small and Slow Solutions Use and Value Diversity
- ► Use Edges and Value the Marginal
- ► Creatively Use and Respond to Change
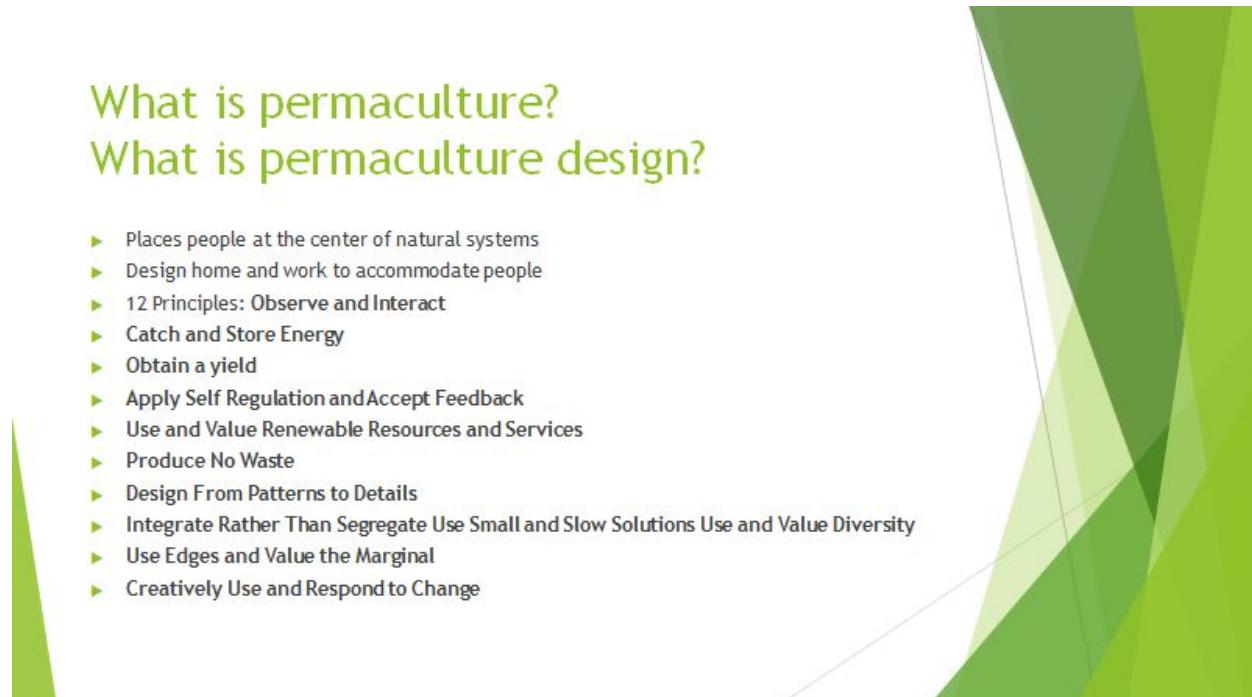
Permaculture designers embrace 12 guiding principles for designing for sustainable human existence and ensuring forward progress for a community and homestead like Permala.
We live here, we share this home, so everything we create should take us into consideration to enhance our lives while living with a small or even carbon negative impact.

We'll catch and store energy using solar panels, rain, and even heat for hot water from compost piles.

If we need to spend money upfront to get our garden going, that is OK! We know that good seeds, rich earth that can be purchased from composting facilities, and reliable electric tools will help us obtain the yield that will continue to grow as our success compound.

If something isn't working, we will acknowledge and fix it. This can also mean getting input from our visitors and guests to continually improve, or noticing when the garden is dying - what changes can we make to do that?

Small and slow solutions can help us avoid major and costly mistakes, like planning a garden where the dogs like to run.

Producing no waste can mean reframing our beliefs about trash. Even plastic bags can find a permanent life as insulation.
We will continue to watch for positive patterns and adding to them. Seeing that an oak tree is growing well somewhere is a good indication that the soil conditions are favorable to mulberry as well, based on research by soil biologists.

We integrate the large oak and the smaller mulberry to prevent pathogen problems associated with monoculture, and keep our chickens involved in the gardening by moving their tractor rather than cooping them up in a static structure.

Valuing the marginal means accepting "weeds" into our lawn or garden so that these native wildflowers can provide food for bees, or even picking up other peoples' yard waste that we can compost and use for biomass in compost production.

To make this all happen, we will view problems from multiple points of view, and put our research capacity to work when confronted with unexpected setbacks, always looking for unique opportunities where they arise.

Design Elements to satisfy requirements

- Business
  - Easily repaired infrastructure
  - Art studio
  - Workshop
    - Tool storage
- Food
  - Garden area
  - Chickens - eggs
  - Kitchen
- Community
  - Gathering space
  - Adequate facilities
    - Bathrooms
- Ecologically sound
  - Free energy sources
    - Wind, solar
  - Rain collection
- Enjoyable
  - Looks, smells, feels nice!
  - Space for games!

After reviewing the requirements, these are the minimum elements of the design that must be incorporated.

Knowing the design elements that we need to incorporate is simply not enough. We must consider their physical and chronological placement. We planned our layout based on zoning for each aspect, and the zones are based on distance from the primary living spaces.
 To stack functions in time and space, we allot different areas to different functions at different times, and try to achieve complementary relationships between these. For example, our chickens are periodically moved across space that we have planned for future gardening so they can scratch up the dirt, acting as mini-tillers all while fertilizing the earth with their waste.

Design Context
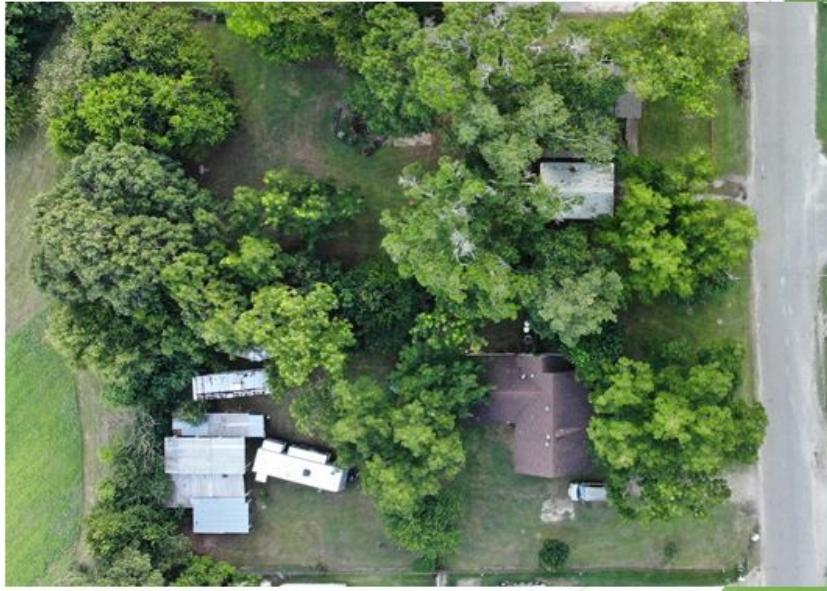
The map that we analyzed to determine zoning.
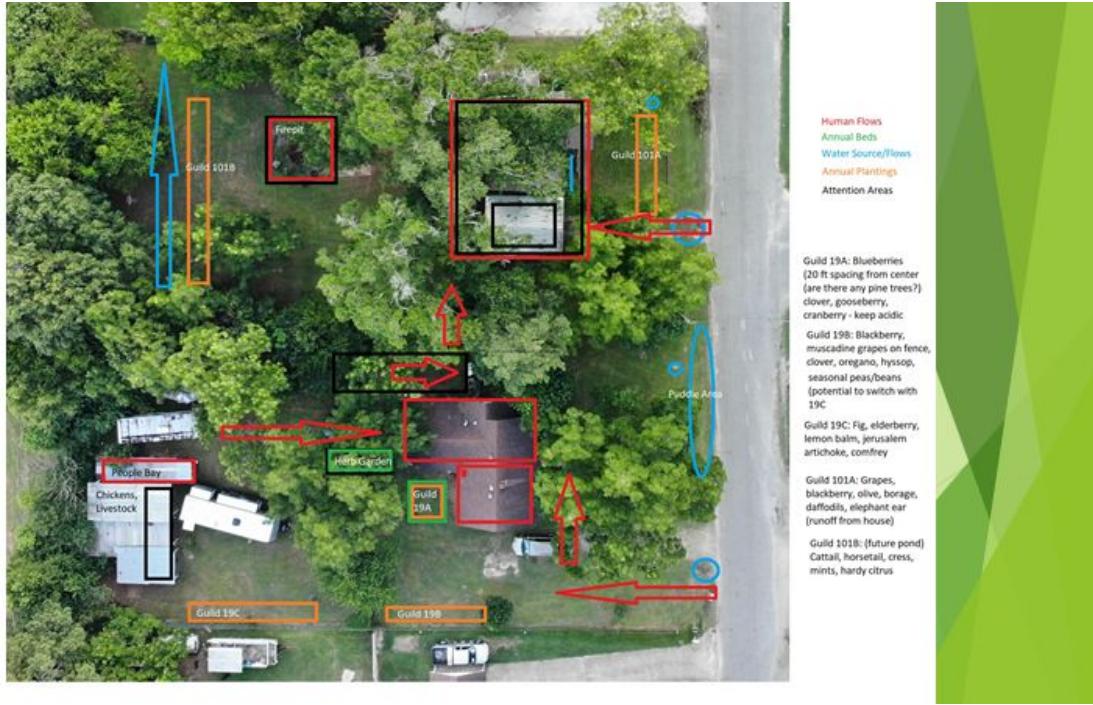
Observations about human activity in given areas helped inform our design, as we thought through the requirements and considered what elements to add to what already existed.

Permala Zones

▶ **Zone 0.** The Home. Indoor production (sprouts/ferments) and processing of food, waste, water collection, repairs and education.
Zone 1. Immediately outside – frequently used, place elements for continual, observation, tending and harvesting, filling non-indoor activities (smoking, relaxing)
Zone 2. Managed areas with animals needing daily attention eg. poultry, rabbits, worm farm, snail farm. Orchard trees, slower-harvest annuals (artichokes, brusslesprouts)
Zone 3. Occasionally visited areas with self-fed animals (stock) and seasonal wide-ranging crops eg. corn, wheat, rice, pumpkin, bamboo – some transit spaces
Zone 4. Wild food gathering (eg. nuts, native fruits) Wood for Fuel, self seeding trees - secluded space for community breaks
Zone 5. A Natural area - a rarely visited area. This zone is best linked with neighbouring wildlife corridors - water collection

These are our zones, defined.
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Next, we mapped these zones based on conversations about where people often gathered, what part of the yard was being used for what and my own observations.

Zones
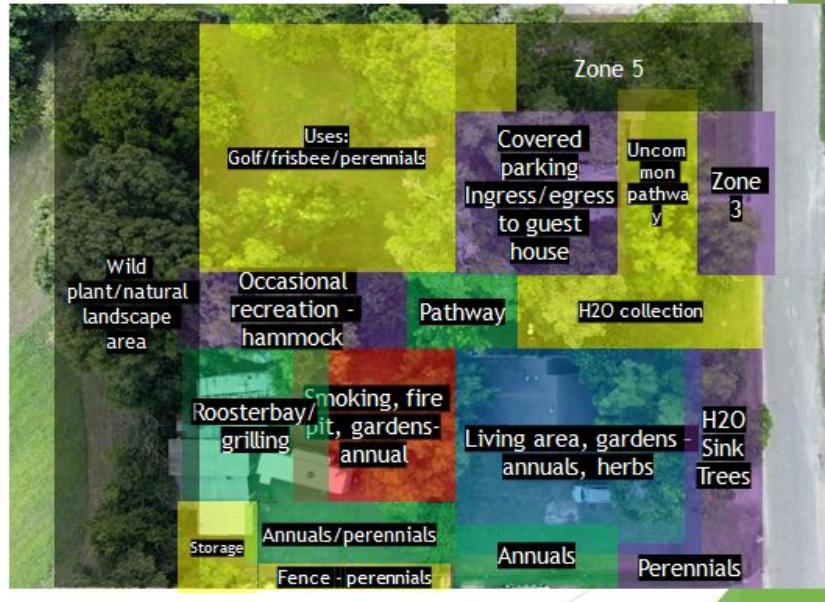
The map of the functions we assigned to each area within the zone. These assignments are based on community feedback, and can serve to help a new visitor or guest understand what is going on. These also inform future design decisions about where to place new elements based on what complimentary functions might exist. That is, if we decide to put in a pond, we will want it to go in a wild area. Whereas a hot tub might go into a recreation area, or even by the firepit.

Solutions – Physical and Cognitive

- Communication
  - White board
  - Try different software
    - Whatsapp
    - Group-text
    - Slack
    - Groupme

No design survives first contact with the real world. As the community and garden began to grow, we implemented some iterative solutions - and made plans to do more.

Communication difficulties were solved by painting a wall that needed to be painted anyway with whiteboard glaze. This room, sometimes functioning as a workshop, then became a good meeting space and hub for all communication. Writing something on the board that could not be communicated in real time is a good way to let the rest of the house know something like "Dinner tonight at 8!" without digging out any electronics, which could be distracting to enjoying the outdoors, or have been placed to the side and not checked.

Reported Challenges – Solving with Constraints, Information in the world, Appropriate Technology

▶ Misplaced tools

    ▶ Roster

    ▶ Outlines

Putting a tool rack in plain sight is a great way to keep track of what tools are available and which ones might be in use. Outlining them on the wall keeps all users accountable. As a side note, using the workshop room as a music studio brings people in, who might notice when a tool is missing.

Misplaced tools can be located more quickly with a roster to know who has had the tool last, or who has it now. Hanging a card with your name on it where the tool is supposed to go removes the tedium of finding a pen and writing, or remembering to sign it back in. Simply grab your name card and put it back in the drawer when you return the tool.

Floorplan for 3D Model

To help brainstorm kitchen crowding issues and give us options to rearrange the house simply, without actually spending effort moving things, I created this 3D house model. It allowed us to move furniture to preview spaces before going through the tedious task of actually moving them, only to find out that they were not in a good place.

Current Kitchen Layout
Fridge Obstructing Path

Fridge Removed

Fridge Relocated
Potential Location
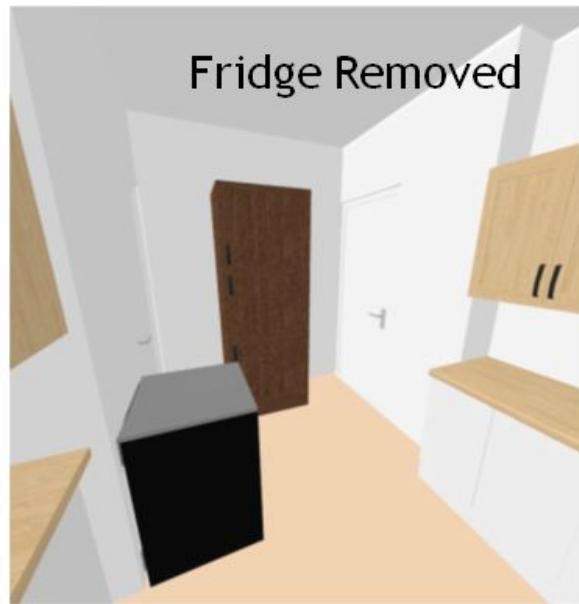
This tool saved a lot of effort.

Reported Challenges – Solving with Constraints, Information in the world, Appropriate Technology

▶ Overwatering – Resource Waste
  ▶ Automated controls/schedule+instructions posted by faucet (constraints, information in the world)
▶ Smells – dog excrement, rotting compost, cigarettes
  ▶ Dog training (certain areas)
  ▶ Introduction of black soldier flies
▶ Plant identification/confusion
  ▶ Map
  ▶ Resilient signage

More reported challenges came in the form of overwatering. Short of being able to save up for automated watering systems, a device that could be constructed out of scrap materials helped as a mnemonic device to get information into the world.

Physical Checklist

Task written on tag → Feed BSF

Hinge

Orange Bottomless

Flip when task complete

clean house

Water plants

Harvest

Put pots inside bay

Check email

Meet (1/week)

Clear dishes out of sink

Feed chickens

-Puts information in the world
-More noticeable than whiteboard checklist
-Physical manipulation aids memory
-More satisfying than marking X
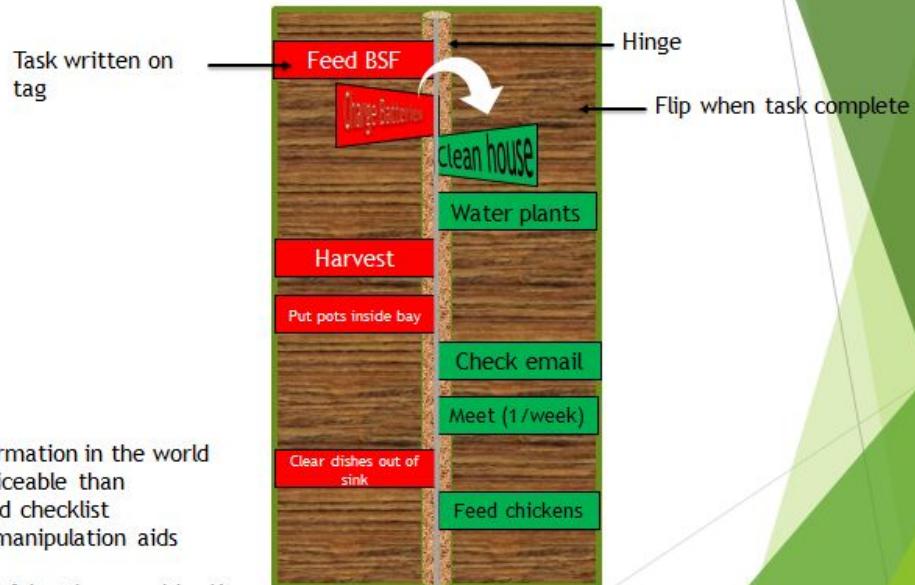
A physical device that has distinct markings and clear indicators of whether or not a task was done helps in a communal setting, where it is not always easy to see what others have accomplished. Redundancy in tasks helps things get done, but sometimes they can be overdone and effort wasted.

Garden Solutions – Memory Aids

- ▶ Plant Care – Cognitive
  - ▶ Maps
    - ▶ Interactive
    - ▶ Paper
  - ▶ Reminders
    - ▶ Countdown
- ▶ Geotag guilds for phone access
  - ▶ QR codes
  - ▶ Engraving machine
    - ▶ Supports arts/crafts

PEACH

Tag links to peach information
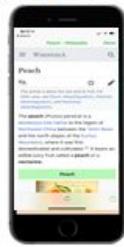
Not everybody who eats out of a garden has to know what every plant is. It can get confusing! But, the design is here to help. Those just visiting Permala are often curious to know what certain plants are. Plant maps overlaid on the property map are helpful, but not always on hand. Writing paper labels, even those that have been laminated, does not always work because the sun fades them and water finds a way in. Engraved tags are a good solution - and for those who want to know more, QR tags that pull up information on a smart device. While an engraver is an expense to Permala, it might turn out to be a multipurpose device, as manufacturing/repurposing of old items becomes a more lucrative business. That is, aluminum cans can be upcycled into art using such a device, fulfilling more of Permala's eco requirements.

Garden Solutions - Ergonomic

- Raised beds - 36" at top
- Hugel mounds - steps/handholds - steep sides
  - Up to 5' tall
  - Built from materials on site
  - Use dirt from excavation projects
    - Add to list for excavator rental

Some people at Permala have better joints than others. To accommodate the widest range of gardeners, there are some ergonomic solutions to growing plants without bending over and creating back strain in workers. Hugel mounds are dirt piled onto logs. The logs break down over time and serve to retain water in the soil as they rot. The novelty of a big plant wall will definitely get some outside interest, as well.

Ergonomic Coop Design - Mobile

- Dimensions
  - Fit through garden areas
  - Correct lifting height for transport - slight knee bend
  - Good height for egg retrieval door
- Materials
  - Durable
  - Cheap
  - Lightweight
- Visually pleasing
  - Golden ratio
  - 2' high, 3.2' wide, 4.7' long

Nesting boxes

Roof - not shown

3.2'

Handles – slightly bend knees to lift

Gutter - hose to waterer

Water hanger/perch

Drop door

2'

<- Chicken nipples

3.2'

Wheels

4.7'

Taking care of chickens can be simplified with a custom coop. Most coops are immobile. Chickens derive great benefits from being able to roam on fresh grass, but free range chickens are in more danger of predator attack. Enter the Permala ergonocoop. It can be wheeled onto fresh grass every day, using the wheelbarrow -ike handles at the light end of the coop. The roof is sloped to collect rain and automatically fill a waterer. Getting regular waterers in and out of small coops is a recurring problem, and this design solves that issue nicely. The eggs are accessible from a door at around waist height on the other end, meaning no extra bending when harvesting eggs, either. The lightweight coop is reinforced by a center bar, which doubles as a perch. Designed with both humans and chickens as stakeholders, this is a supercoop.

Resource Conservation

- Collect rainwater
  - From washer - greywater
  - Raised catchment near house
    - Flat RV tanks upright
    - Doubles as insulation/heat sink
    - Wash produce in basin
- Basin enables stacking of functions
  - Close to house
  - Can be configured to use hot water (roof tanks)
  - 30" tall, hook-in basket for hosing off carrots, etc

Gutter

Diversion

Narrow Tank

Spigot Connects to hose

Wash basin

Drains to garden/biofilter
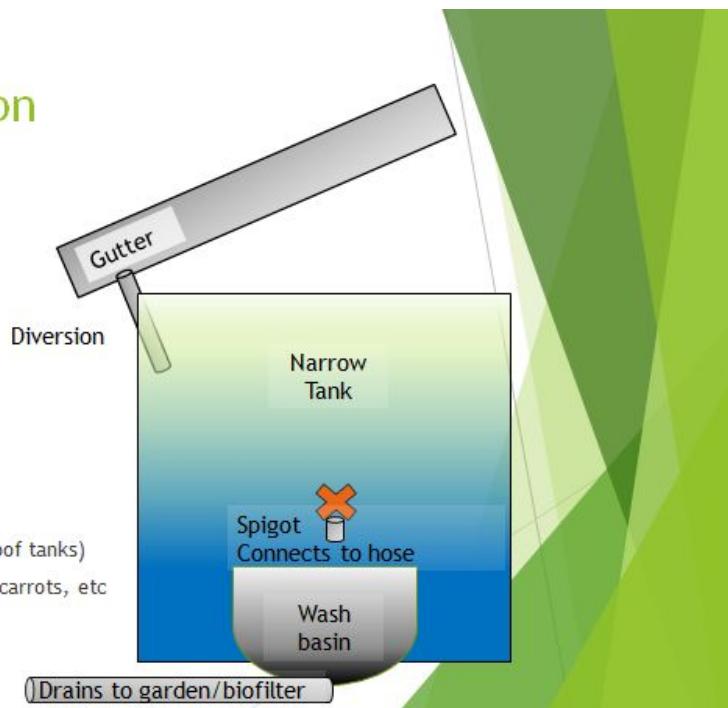
Conserving resources to decrease utility bills and maximize what nature offers for free is another goal that Permala can solve with good design. RV water tanks are routinely thrown out, but they can be salvaged and upcycled into useful fixtures. This design fits against a wall near an exterior door. It collects and stores pure rain water. Its functions are simple and require no explanation - the water is visible, the spigot handle is big enough to be turned with a knee, free limb, or even a weak hand, and it is ideally placed.For hand washing or vegetable washing on the way into the house, and it drains into the garden, further conserving a precious resource. An added benefit is the high specific heat of water. That is, it takes a lot of energy to heat water up, and it can function as a thermal battery, releasing stored heat into the house on a cold day, and stopping the house from heating up so quickly in the summer. Best of all? It requires virtually no human interaction to accomplish these tasks. Good design!

Resource Conservation

- Water on timers
- Collect rainwater
  - From washer - greywater
  - Raised catchment near house
    - Flat RV tanks upright
    - Doubles as insulation/heat sink

Projection of the proposed tank on side of house.

Chestnut Guild
Companion plants:
Black locust, goumi, licorice, dandelion, yarrow, comfrey, astralagus, burdock, senna – 3 sisters for succession

Chestnut

Chestnut

One of the biggest goals of human factors and permaculture is to keep the human in the loop without putting too much strain on their mind or body. It turns out, some of the functions that people have allocated to modern gardners, such as weeding, pest control, and fertilizing can be accomplished by other sources, including other plants. Attracting the right kind of spider or wasp to eat the pest that is eating your tomatoes can be accomplished by using what is known as a "guild." Horticulturists have been experimenting with these methods for years, and some successful guilds have been established. The chestnut guild is focused on the nut tree, but contains many useful species that grow well together. It is yet another way of designing that reduces the burden on people to free up time for enjoyment rather than work.

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"Psychogeography"

The concept of synomorphy assumes that the shape and design of the environment where group members interact inevitably shapes their dynamics: for better and for worse

This presentation has included an overview of the house layout, various tools Permala can use and develop in the future, and explanations of how human factors design and permaculture design can work together to plan other communities like this one. Synomorphy theory suggests that what we build around us in our environments directly affects our group dynamics. If we are to be a community, let us build the world around us with care and grace, and definitely good, conscious, human-centric design.