Designing a Handwashing Station for Rural Vietnamese Households
Reporting from a weeklong design workshop, Ha Noi
Workshop Report.

- Goals & Structure.
- Initial Observations.
- Initial Prototypes
- Prototype Testing
- Final Directions
Goals & Structure.

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Goals.

To develop a rough design for a handwashing station that can facilitate handwashing with soap (HWWS) among rural households in Vietnam.

The design effort will focus on a solution to be mass-produced by a local or regional manufacturer. The produced handwashing stations will be distributed through grass-roots organizations and/or the private commercial sector.
Structure.

The workshop activities included:

1-day in-office review of overall project and current HW practices in Vietnam and across globe
1-day field visit to Hun Yen province for group interviews with female villagers, pupils and teachers and brief visits to three households
2-days of brainstorming and prototyping
1-day field visit to Hun Yen province for group and one-on-one reviews of prototypes with villagers (total interaction with ~15 villagers)
1-day of documentation
Participants.

The one-week workshop was undertaken in Ha Noi, Viet Nam, from April 24th-30th, 2009, in conjunction with the WorldBank, IDEO, PATH, the Ministry of Health and the Women’s Union.

Participants:

Jeff Chapin, IDEO
Jacqueline Devine, WorldBank
Nguyen Dinh Dzung, PATH
Tran Thi Hong, Women’s Union
Truong Dinh Bac, Ministry of Health

Tom Outlaw, UNC
Nguyen Hien Minh, WorldBank
Nop Thunvuth, PATH
Nguyen Quynh Hoa, Women’s Union
Duong Chi Nam, Ministry of Health
Initial Observations.

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Methods We Used.

- group interviews
- ‘existing’ HW station cards
- HW station drawing
Most villagers stated that they typically sit or squat while washing their hands. They would want the handwashing station to be positioned in such a way to enable this position.
Fixed, not free.

Villagers universally preferred that the handwashing station be permanently affixed in one location rather than being a portable unit. They felt that this would make it less likely to be lost, damaged or used by children as a toy.
Villagers strongly preferred that the handwashing station to be hung rather than set on a stand or shelf. Hanging is viewed as more permanent, better fits with the preference for fixing the station in one place and allows more flexibility in installation. It also does not require the purchase or construction of a stand.
All the villagers stated that they would bring water from the well or tap to the handwashing station in order to refill it rather than bring the station to the well. They would expect to refill the handwashing station every 1-2 days.
In terms of water taps, there was a preference for taps that can be operated without getting the tap and spout dirty. Can the tap be operated with the wrist? Back of hand? Although the Ministry of Health advocates for taps that don’t waste a lot of water, we didn’t hear this explicitly from the women.
Saving soap.

Current handwashing behaviors with liquid and dry powdered soaps actually use far more soap than required. The “finger-pinch” of dry powder is actually quite a lot. Enabling villagers to use moderate and appropriate amounts of soap will be critical for making regular handwashing with soap financially feasible.
Villagers didn’t seem overly concerned with solutions for handling the wastewater. Shallow basins are abundant around the house and often used in a wastewater collection capacity, and they could be readily co-opted for collecting handwashing wastewater and moving it to the garden for irrigation.
Village women are focused on different critical junctures than what the HWWS project emphasizes—specifically, after chicken feeding (avian flu) and when coming back from the fields or gardening. They didn’t really even mention three of the four other ones... pre-cooking, pre-eating & post-baby changing.
More than one but maybe not enough.

Women stated that they would likely purchase two HW stations (one for garden and one at chicken coup) plus one more for latrine if no water basin in latrine. There was no mention of cooking, eating or baby changing areas. Getting the HW stations installed near the MoH/WSP critical junctures may prove difficult.
As hoped, the village women freely stated that a well-placed handwashing station would help remind them and their family to wash their hands. They also thought it would be good if the handwashing station could help them remember proper technique.
A woman’s decision.

Village women would be the sole deciders in a handwashing station purchase. The women have purchasing discretion for daily house-keeping and house improvement items to upwards of one million dong. They might engage their husbands for installation advice and services but not for purchasing.
When shown images of existing handwashing stations that reuse old water, soda or other liquid bottles, most village women scoff at the idea. They may not have a lot of money, but they have some vanity. A handwashing station is something new in their lives. They want it to be a new product.
Villagers quite consistently stated that they would be willing to spend 50,000 duong on a handwashing station. At least to the women we talked to, this seemed like an amount of money that could be fairly readily gathered for such a purpose.
Aesthetics and choice.

Village women stated a willingness to spend more for a handwashing station were it to be visible to other villagers. If there were two versions, they would purchase the more expensive version for public areas and the less expensive version for behind their houses, by the latrine or in the garden.
Village women buy durable goods (buckets, bins, basins, etc) at commune-level markets. Consumables are often purchased at village markets. From a user perspective, turnover and distribution perspective, the commune market seems like the right target for a handwashing station.
The women’s union seems to have tremendous power and influence over village life, impacting the behaviors of all villagers, female or not.
Initial Prototypes.

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Prototyping Process.

Prototypes were developed over the course of 1.5 days of brainstorming, shopping and building. The prototypes were primarily built by deconstructing, altering and re-assembling objects which could be found in local markets. The prototypes were built to test specific ideas and thoughts, not to be representative of actual product designs or future manufacturing methods.
Prototyping: Brainstorming.

This field note aims to explain the concept of household demand for sanitation in developing countries, what stimulates demand among new adopters, and how this knowledge can be used to develop marketing strategies to accelerate sanitation uptake. It draws these insights from an in-depth study of household latrine adoption behavior in rural Benin.
Prototyping: Shopping.
Who Buys Latrines, Where and Why?

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Prototyping: Building.
Prototypes.

Three sets of prototypes were developed to independently test the critical components of a handwashing station:

A1 & A2: developed to test four water dispensing options—looking at desired hand motions, flow rate and lever styles.

B1: developed to test five soap application options—looking at desired soap style, hand motions and dispensing alternatives.

C1-C6: developed to test variables related to the container size, shape and feature set.
Prototype A1.

A1 incorporates two tap options: a water-dispenser style push lever (on the left) and a vertical 90 deg ball valve (on the right).

The push lever is sprung loaded so that the valve only remains open while the user is pushing it. Though it dispenses a small amount of water, the user does have some control over flow rate by pressing in the lever more or less.

The vertical valve dispenses a variable amount of water depending on the amount the handle is turned. Though the user has some control, in general the valve dispenses a large amount of water relative to the other valves options. The valve remains open until the user chooses to close it.
A2 also incorporates two tap options: a horizontal-handled 90-degree ball valve (on the left) and a ball-in-cone push valve (on the right).

The horizontal handle valve dispenses a variable amount of water depending on the amount the handle is turned, and it remains open until the user chooses to close it.

The push valve requires the user to push up on the bottom of the elastomer cone where a steel ball is positioned providing a seal with the cone. The ball has a small vertical protrusion coming out the bottom to help the user locate and manipulate the valve. The valve only remains open when the user is pushing up the valve. The user can control flow rate by pushing up more or less.
Prototype B1.

B1 incorporates five soap dispensing options:

**Bar in bag**: a bar of soap is contained within a plastic mesh bag and suspended from the bottom of the container by a string.

**Dry powder shaker**: Powdered laundry detergent is held in a talcum powder-type dispenser and suspended from the bottom of the container.

**Liquid nipple**: liquid dish detergent (or dissolved powder) is held in container with an elastomeric nipple dispenser. The nipple is squeezed to dispense the soap.

**Liquid ball valve**: dissolved powdered detergent (or liquid dish detergent is dispensed through a push-up ball valve similar to that described for water dispensing.

**Bar soap shelf**: a bar of soap is held on a covered shelf on the side of the container.
Prototype C1 & C2.

C1 is built from a clear, round plastic container of a 10L volume. The container is typically used for food storage. It has a relatively high height-to-diameter aspect ratio (roughly 2:1). It has a screw-on lid, and it can be placed on a horizontal surface or hung from the provided strap. The wall thickness is quick thin, so as to make the container quite flexible.

C2 is a red, round, plastic bucket of 14L volume and is typically used for handling water. It can be placed on a horizontal surface or hung from the white plastic handle or the provided hanging strap. The container has relatively thick walls so as to seem quite sturdy and it has a removable round lid (not pictured). It has nearly a 1:1 aspect ratio.
Prototype C3 & C4.

C3 is a manifold for holding four 1.5L (or 2L) emptied soda bottles. It can be placed on a horizontal surface or hung from the provided strap. It can be refilled by pouring into the opened bottom end of just one of the bottles (the liquid level would equilibrate between all four bottles).

C4 is a welded vinyl bag with a valve at the bottom which allows for water dispensing. A PVC pipe runs through a channel on one side of the top of the bag, giving the whole bag structure and providing a place for a mounting strap to be attached. The bag must be hung to be used. The bag opens at the top (much like a purse) for filling purposes. A flap from the non-PVC pipe side of the bag flips over the top to close off the bag opening.
Prototype C5.

C5 is a rectilinear plastic container of about 10L in volume. The container is most typically used as a trash can in Vietnam. It is quite thick-walled and is the most robust of the container prototypes. It can be placed on a surface or hung by the provided strap. It has no lid in this incarnation.

C5 was also used to inquire in more depth about hanging preferences. Side holes with an associated strap as well as three holes on the back surface were built into the prototype.
Prototype C6 & C7.

C6 incorporates a flip-type flat lid mounted to the container base via two ties passing through matching holes.

C7 incorporates a removable lid.
Prototype Testing.

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Prototype Testing.

All of the prototypes were taken back to the Hun Yen province but to a poorer village than where our original user research was undertaken. We shared each set of prototypes with a collective group of about 20 villagers with a approximate 50:50 split between men and women. The villagers were asked to come forward and use each set of prototypes. After each set was tried by a number of villagers, we facilitated a discussion amongst the villagers to discern likes, dislikes, comparisons and suggested changes.
People strongly preferred a tap which would allow water to run freely. They need to rub their hands together under running water to get rid of soap. If they need to continuously depress a lever while doing this, it makes rinsing very difficult.

People also strongly preferred a tap which allowed control over flow rate versus on-off binary control.

People wanted to be able to control on-off with the back of the hand or some other clean part. . . not the finger tips. Allowing this less dexterous control will be important for actually keeping the tap clean and for having people perceive it as being clean.

People mentioned that a benefit of the push tap was that it was somewhat self-cleaning since the water ran over the part you push with your hands.

Vertical valve. . . too much water flow. Was stiff and hard to turn. Didn’t know which direction to turn it.
Taps.

The push tab was associated with drinking water dispensers and some people mentioned that they could use it for that purpose. Not sure how much we want to worry about this potential repurposing, but perhaps there are some simple things we can do playing with colors and shapes so that the design works well for washing hands but not so well for water dispensing.

Preference for a shorter handle for aesthetic purposes (on horizontal tap). Also would prefer a vertical tab on handle to make it easier for handling.

Ball-in-cone valve was not liked at all. Was very unfamiliar to them. Did not know how to use it.

Concerned that horizontal valve would break internally. Villagers had experience with a similar valve that they said cost 25,000d. This was likely a Chinese copy of the valve we showed them which cost 60,000d.
Soap.

People really liked the bar soap options. There was preference for the hanging bag versus the covered dish. The bag would let the soap dry out better, keep it drier if hanging under the shelter of the basin and would make the soap less likely to be lost/stolen.

People commented that they don’t wash their hands with laundry soap. That it has chemicals in it that are not good for hands and skin. As a side note, it’s also true that laundry soap is the hardest to wash off of your hands and requires the most water to rinse.

People expressed concern that the powder shaker would get clogged when the soap got wet. They also weren’t keen on having the touch the bottle to turn it upside down to shake when their hands would be dirty. Having to shake it was viewed as inconvenient.
Soap.

People did not readily understand how to use the dissolved powder dispenser. It was a similar confusion that arose with the ball-in-cone valve for water dispensing. Since they didn’t know how to use it, they were very tentative in using it.

Liquid soap nipple dispenser was a bit finicky to use. It requires fine motor dexterity and not the larger gross motions that seem more desirable when one has dirty hands.

For the sake of prototyping we used baby bottles as part of the soap dispensing units. This was very hard for people to look past. Any future prototypes should divorce themselves from products or shapes with strong existing connotations. Soap clearly does not belong in a baby bottle...
Containers.

On purely aesthetic purposes, the preference between round and rectilinear containers was split.

From a functional perspective, there was consensus that a rectilinear container would rest better against a wall when hung.

People strongly preferred mounting the container on a wall or post rather than resting it on a stand. Mounting it on a wall seemed a more permanent, fixed installation, and this was desirable.

For hanging, there was split preference between mounting with a string tied to the container or directly mounting to a nail or piece of rebar through a hole in the back of the container. Providing the flexibility of both options seems best.

Again, people stated that they would bring water to the container to refill it rather than bring the container to the water.
Containers.

People preferred a flip lid over the removable lid. Would be easier to operate when refilling and less likely to be lost if attached well. They also mentioned that it would give a better seal to prevent mosquitoes from getting in, though it seems that both types of lids could provide equally good seals if designed properly.

Preference for a clear container that would allow people to see the clean water inside and see the water level.

All wanted bigger containers...15-20L. Wanted to refill every 2-3 days.

Didn’t care for the recycled bottle container. Wanted something new—not used. They don’t necessarily want a HW station yet, but they want it to be nice.

Didn’t care for the hanging bag. Wasn’t big enough. Was very foreign to them. Never seen it before.

No need for portability...prefer fixed in one place.
Final Directions.

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Final Directions.

The following series of drawings reflect my recommendations for what should be built in the next round of prototyping. They reflect the learnings from the prototype testing and some filtering based on perceived schedule constraints of the project.

When prototyping from this point forward, remember that prototypes which will be compared to one another (e.g. dispensing taps) should all be built to the same fidelity in terms of materials used, performance, construction quality, etc.
The horizontal paddle evolves a commonly-available tap design for use in a handwashing station. The large paddle surface allows operation by the wrist or back of the hand, keeping the handle surface freer from dirt. As with the current design, the tap allows the user variable control of flow rate, and the tap remains open until the user manually closes it. The paddle handle should extend below the level of the container to allow access to it, but the handle should not extend below the level of the water outlet—otherwise it will likely get in the way when washing. Note that for this tap in particular, but all the taps in general, achieving a light action (i.e., an easy-to-rotate handle) will be important for keeping the container from moving around when the user operates the tap. Special care should be taken in the engineering and material choice for the handle to reduce failures.

*note that in the drawing the open and closed positions are accidentally reversed.
The vertical paddle provides a slightly different user motion than the horizontal paddle which should allow the same benefits (wrist or back of hand operation, less dirtying of handle) but should require less dexterity to operate. As with the horizontal paddle, this tap allows the user variable control of flow rate, and the tap remains open until the user manually closes it. Again, the handle should not extend below the level of the water outlet—otherwise it will likely get in the way when washing. Some early thought should be put into the internal valving mechanism to make sure this design would be feasible. Analogous valve designs should be sought out.
The push paddle merges the positive features of a typical water-cooler valve with the positive features of a ball valve. When the user places his hands under the tap, the large paddle is pushed back and water begins to flow. Unlike current water-cooler valve, however, this one is not spring-loaded closed, so the user does not have to retain pressure on the paddle to keep the water flowing. This allows to user to rinse their hands without also having to hold open the water flow. But, as with a ball valve, the user does have to manually return the paddle to the closed position to stop the flow of water. With its proximity to the water stream, the paddle surface will be incidentally splashed with water which will keep it clean. To prevent repurposing as a drinking water dispenser, the paddle can be placed far enough back on the faucet shaft to make the whole design inconvenient for use with water glasses.
Tap: Ball-in-cone (Hamster) Valve.

Though it did not test well, the workshop team liked this idea enough to recommend pursuing it for one more round of prototyping. In this incarnation, the ball should be provided with a significantly longer arm so that the user can see it when approaching the handwashing station. The arm should have some larger diameter disk at the bottom which affords a pushing-up motion and which helps distribute the dispensed water. Though the valve does not enable continuous flow of water (a desired feature based on the first round of user testing) it should allow the most efficient use of water (a feature not tested in the first round). When tested again, a proper demonstration of function should be given so that initial confusion over how to use it does not overly affect user perception.
Container: Rectilinear.

There was enough convergence around the shape and features of the container that the large variables are mostly removed. The container should be roughly rectilinear, particularly the back surface which will come into contact with the wall when hung. Hanging holes should be provided but hanging hardware and technique should be left to the villagers—illustrations of options will suffice. An industrial designer should be retained to give the container some life and make it less like a trash can and more like a handwashing station. The container should be translucent to enable the user to view the liquid level. Crystal clear is probably not ideal due to higher incidence of sunlight-promoted algae growth relative to clouded or opaque containers. Some coloration of the container will also help hide discolored water and minor algae growth. Color studies can be done post-tooling. A final volume should be decided upon and should depend on actual water consumption, cost implications and hanging weight. The lid and soap features need to be developed and incorporated.
Soap: Suspended Bag.

This very simple solution tested quite well. Further prototyping should include explorations in bag materials, bag construction and mesh sizing. With a fine enough mesh the bag may also be able to hold dry detergent and not just bar soap--both variations should be tested. Some longer term use testing should be performed to see how well the bag and soap hold up to use. The length of the hang strap and the location of the bag should be prototyped. Mounting features on the container should also be explored, particularly around their impacts on manufacturability.
Soap: Side Pocket.

Another simple solution, the side pocket provides a designated place for the user to leave bar soap. Prototyping should explore necessary depth and size of the pocket. User accessibility to the soap should be tested, and performance testing in rainy conditions should be undertaken. Also, since this design is almost strictly a bar soap solution, user appetite for adopting such a restriction should be more deeply understood.

Due to the more complex manufacturing the pocket would require, impacts on tooling, part cost and overall container size (to achieve the desired volume) should also be understood.
Soap: Side Shelf.

The side shelf opens up the soap pocket solution to enable use with all three types of household soaps. It does not, however, provide any type of container for the liquid or dry powder soaps . . . only a place to rest existing containers. Prototyping should explore necessary depth of the shelf with special thought put into the strength of such a cantilevered design. Performance testing in rainy conditions should be undertaken.

As with the soap pocket, due to the more complex manufacturing the shelf would require, impacts on tooling, part cost and overall container size (to achieve the desired volume) should also be understood.
Soap: Split Container.

The split container holds a large volume of water and a much smaller volume of soapy water (water plus either powdered or liquid soap). Both liquids are dispensed through taps. The tap design should be based on the learnings from the tap exploration. The taps should likely be slightly differentiated to allow the user to discern their different functions. Color and or shape difference can help communicate ‘soap’ vs. ‘water’. A translucent container will also help in this regard.

User testing should focus on user appetite for such a solution and on user perception of diluted soap and their understanding of the process of diluting soap. The proportion of soapy water to clean water in the container should be optimized, and the ideal mix ratio of soap to water in the soapy water needs to be determined.
Next Steps.

This project is far from complete. The design and manufacturing ramp-up of a product such as this takes months and costs money. There is no getting around it. The list of things left to do is considerable, but I’ve listed a few high-level topics below that should guide future efforts.

Design iteration
Costing
Manufacturing partners
Supply chain survey
Project budgeting
Design Iteration.

Expect four to six more rounds of prototypes before reaching a final product design. Each iteration should include ideation, prototyping and user testing. As the design progresses and the design reaches higher fidelity, each iteration takes longer and the prototypes cost more money to build. The upside is that in later iterations, the prototypes begin to look like a real product and user affinity for them increases exponentially. When the prototypes become robust enough, a small set should be constructed and longer-term use testing should be performed to get more detailed and real-life feedback.

You will need to enlist the help of an experienced product developer to move through this process. There are engineering, manufacturing and industrial design challenges ahead and someone will need to coordinate all that work.
Costing.

We have pretty firm retail cost targets: 50,000d, maybe up to 70,000d if the product looks really nice. If we do not hit these, we probably don’t have a product. The manufacturing costs of comparable valves and containers should be determined, and potential cost-performance trade-offs should be understood early. For reference, the rectilinear plastic containers used for the prototypes cost 45,000d and the plastic ball valves cost 20,000d when purchased by a Westerner in the Ha Noi Old Quarter.

Typical transportation and distribution costs should also be determined and retail mark-ups understood. In parallel, projected tooling investments and lead-times should be calculated. As the design progresses and design decisions are made, the impacts on both part costs and tooling costs should be top-of-mind.
Manufacturing partners.

We’re not the first ones to design a small plastic container and a cheap plastic valve. That’s a very good thing. The manufacturers of comparable locally-available products should be sought out, and enticed to jump on the handwashing station bandwagon. Their expertise will be invaluable in saving time in the design process and money in both the design process and on the final product. They may be willing to do some of the design and engineering work for free. But remember, you get what you pay for. They may shoulder some of the tooling costs, but they will likely want purchase volume guarantees and will also pass along the tooling costs in the form of higher part piece costs. The manufacturing partners should also provide valuable information and connections regarding the distribution of such plastic durable goods into commune markets.
Supply chain survey.

The path from a factory to a latrine wall needs to be thoroughly understood. Who are the middlemen? Where are the warehouses? What is everyone’s cut? Who wants a piece of the pie? Who needs to be educated about the product? Who needs to be won over? How long does it take to get a product from the factory to a consumer? What will the price multiple be? What happens to unsold product? What volumes need to be hit to make it a viable business for someone?

In addition to the commercial sector, the role and contribution of governmental agencies should be explored. What role can the Women’s Union and Ministry of Health play in promoting and advocating for this handwashing station? How might this station fit into their existing handwashing promotion activities and schedule? Is there potential for them to be part of the supply chain?
Project budgeting.

As stated earlier, this process costs money. Money for people’s time. Money for prototyping. Money for manufacturing start-up. A quick survey of potential partners and costs in Vietnam should be done to get better budgetary information. Once known, the money for the work has to come from somewhere. Can WSP fund this type of work? The WU? MoH? Gates seed money? A private company? An entrepreneur with some investors? What about public-private partnerships?
Thank you!

(and good luck! i hope to see millions of these)