

Designing a Language-Agnostic Communication Tool for Fishers

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Abstract

Due to a lack of safety and regulation in the small-scale fishing sector, a communication tool with a reporting feature catered towards small-scale fishers (SSF) is proposed. This paper focuses specifically on the early-design stage of this tool, with an emphasis on making the system language agnostic due to high levels of illiteracy being common in fishing communities. In this paper, we find that there is a large influence of different cultural background factors on icon preferences, as well as a desire for education, compensation, and safety amongst SSF.

Introduction

Artisanal or small-scale fishers (SSF) are typically defined as independent fishers with fishing vessels at or below 10m. These individuals contribute immensely to the seafood industry, with artisanal catches constituting nearly half of the world's catches (Anderson, 2020). SSF are also often the main source of income and food for their families, making essential socio-economic and cultural contributions to coastal communities particularly in remote regions. Despite the necessity of SSF, there is often insufficient information on their activities, as well as inadequate management of their fishing practices. Compared to large-scale fleets, there is also minimal financial investment and protection of self-interest. This lends itself to a persisting cycle of illiteracy. This is partly due to poverty and the economic appeal of the more immediate profit of the profession, over the long-term investment required by education and literacy. Empirical evidence shows that fishing communities have lower levels of literacy than other occupational groups (Maddox, 2007).

In addition to the discrepancies between the treatment of small and large-scale fisheries, there are other activities on the water that threaten SSF' safety. The United Nations Office on Drugs and Crime (UNODC) found that “the fisheries sector is vulnerable to multiple crimes, including corruption, document fraud, illegal fishing and human trafficking. Criminality and

unlawful activities linked to the fisheries sector not only threaten the health of...oceans but also, increasingly, have a negative impact on the economies of coastal countries" (UNODC, n.d.).

"Current enforcement [also] criminalizes small-scale fishers and fails to address root causes, letting large-scale illegal fishing off the hook" (Belhabib et al., 2022).

With this information in mind, the Nautical Crime Investigation Services (NCIS) has set its sights on creating a communication tool aimed specifically at SSF. There are many desired features, such as the ability to emit an SOS signal or report catches. The feature prioritized at this time is that of reporting suspicious vessel activity, such as a vessel suspected of fishing without a license, using illegal gear, or fishing in a prohibited area. The goal of this tool, then, is to increase SSF safety and to provide them an intuitive manner in which to report potential threats. The tool will also be designed to be language-agnostic in consideration of the low levels of literacy in fishing communities.

Related Low-Literacy UI Research

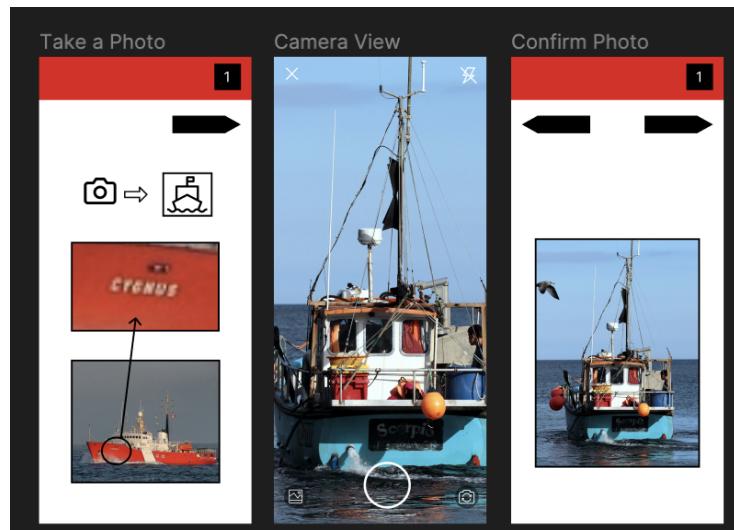
There is an abundance of research done on UIs for low-literacy populations, with insightful findings demonstrating the gap between technologically-literate areas and more rural ones. Discrepancies involving layout can be seen, for example, where technology-literate users can easily navigate nested hierarchies of components in an interface. Nested hierarchies include folders with multiple sub-folders on a desktop or drop-down submenus on a website. Low-literacy users, in contrast, find deep or nested hierarchies confusing, and have consistently preferred systems maximizing a linear flow of pages enabling "back" or "next" actions only. The only exception seen was a tolerance for cross-linked navigation to bring the user back to the home page via a "home" button (Medhi, 2015). This has been contributed to the cognitive load required by deep hierarchies, which require users to remember they are on a hierarchy and to hold it from the root in their working memory (Medhi, 2015). Other features commonly implemented in interfaces, such as vertical scroll bars, were also foreign, with users often unfamiliar and uncomfortable with utilizing the scrolling feature to navigate a screen (Medhi,

2015). Hardware-wise, it is relatively rare to see Apple products, and instead older generation Android and Google phones are more prominent (D. Belhabib, personal communication, February, 2023).

Methods

Study Design 1

The initial study design was to show participants two different interface designs for the reporting feature of the NCIS communication tool (see Figures 1 and 2). Personal communication with Dr. Janzen (2023) from UBC's Human-Computer Interaction department suggested the use of "elevator-pitch" style demonstration videos, comprised of brief overviews of the given designs. These designs would follow differing conceptual models, and online interviews would be conducted via Zoom asking SSF on their opinions on each low-fidelity prototype for the reporting feature of the NCIS communication tool. Note that these conceptual models differed mostly with respect to the features used to support information salience at a given page regarding previously seen pages. Participants were intended to be recruited via snowball sampling, utilizing fishermen's associations and NCIS connections to recruit.



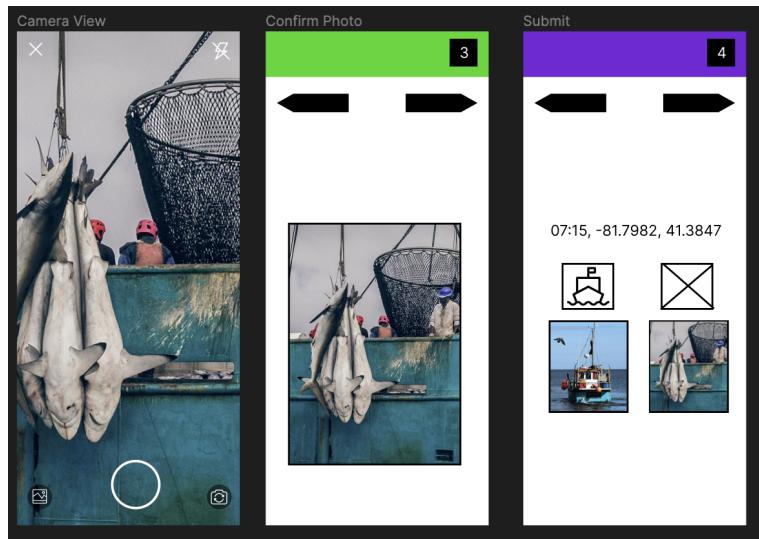
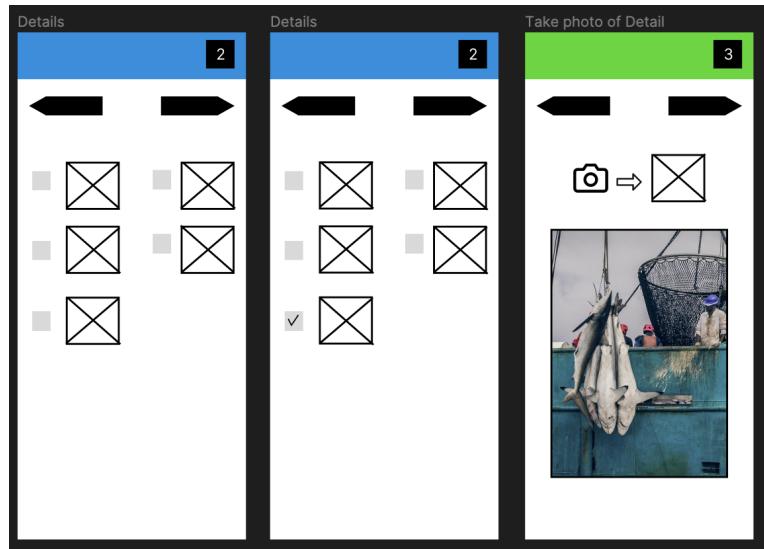
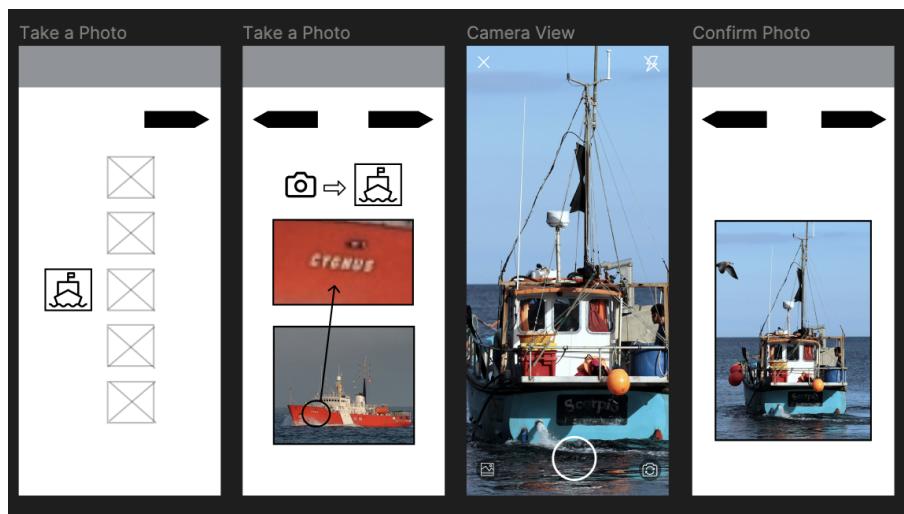


Figure 1. The first wireframe prototype makes ample reference to Agrawal et al's (2013) agricultural tool for rural workers in India.



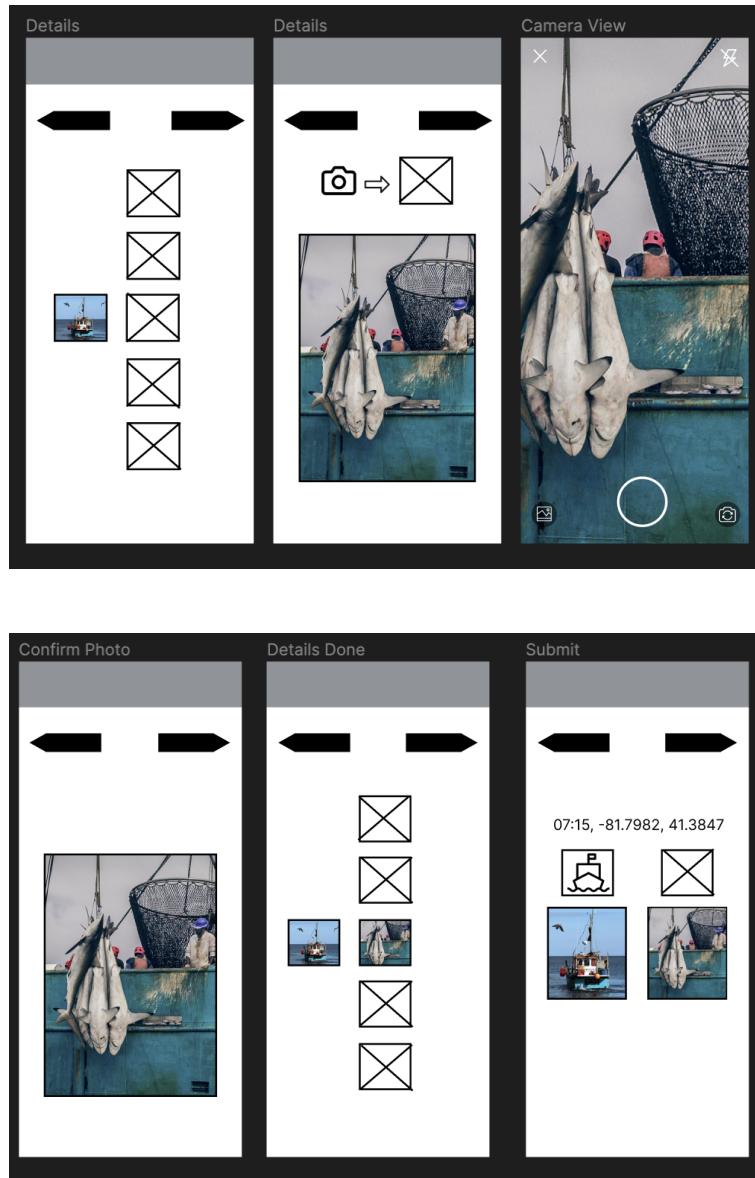


Figure 2. The second wireframe prototype references several papers, predominantly Bhattacharya & Feldman's (2012) text-free search interface for low-literacy users.

Study Design 2

Prototype design came to a standstill when it came time to select icons for reporting categories. Stepping into the perspective of an SSF proved extremely challenging for a student from the WEIRD population, and therefore the design of the icons for use in the tool proved to

be inadequate. Therefore, the original plan of comparing overall layouts for two interface designs became one of (a) providing various icons and asking participants for their opinions on the best/most representative icon, and (b) asking them to suggest their own designs for each icon category should they have their own design ideas. An especially important goal when selecting icons was to avoid criminalizing SSF. Figure 3 shows some of the initial designs and their flaws; more comprehensive and varied research was conducted on what icons may be appropriate to use, which would then be shown to the participants during the studies. Supplementary materials, including the protocol and icons used on participants, are presented in Appendix A.

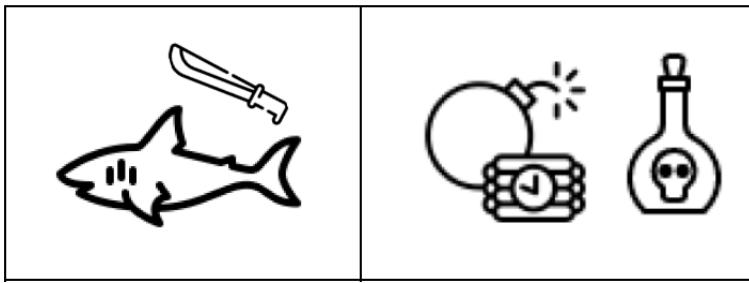


Figure 3. The left photo shows shark finning to represent illegal catch, based on the TLMDS talk by the Director of Campaigns for Sea Shepherd Global, Peter Hammarstedt (2023). However, since sharks constitute only a minute amount of such illegal species fishing, its appropriateness was questioned. The right photo shows explosives and cyanide to represent illegal gear, again based on Dr. Hammarstedt's work. However, this type of gear is typically used by SSF, thus running the risk of further stigmatizing these individuals.

Iconography

Putting the focus on industrial vessels, there were dominant trends found when it came to their illegal gear use and illegal fishing. Illegal gear was typically characterized by extremely large nets of various varieties such as bottom trawlers. Illegal fishing was often observed as excessive amounts of fish atop the decks of vessels (Hammarstedt, 2023), aligning with the decision to move away from shark finning as a primary representation. Therefore, icons

portraying these features were selected as those to show to the SSF participants. The general presence of fishing vessels in illegal areas was represented via large ships, either with or without pirate flags. The transshipment and pirate/weaponry categories of the reporting tool were not included in the interview protocol, with Dr. Belhabib having previously deemed them as adequate.

Participant Demographics

The participant population consisted of commercial and artisanal fishermen and other stakeholders located internationally, from Ghana, Sierra Leone, the Marshall Islands, India and Canada. Other stakeholders included fisheries managers and researchers, as well as a member of the Canadian Coast Guard. As a result of the recruitment process, a total of $n=12$ participants were interviewed, with 6 of those being commercial fishermen.

Results

Quantitative Results

Analyzing participant selections of their preferred icons displayed an extremely large variation in selections. For category 1, a vessel fishing in an illegal area, we see some consensus as seen in Figure 4. For categories 2 and 3, however, there are large amounts of variability, as seen in Figures 5 and 6. Note that there were no statistically significant results, likely due to small sample size, and these findings all derive from trends seen in the data. In summary, almost no consensus was seen among icon preferences. There was a median of 1/12 (~8%) participant selections per icon, with the most agreed-upon icon being icon 4 in category 1 which was selected by 7/12 (~58%) participants.

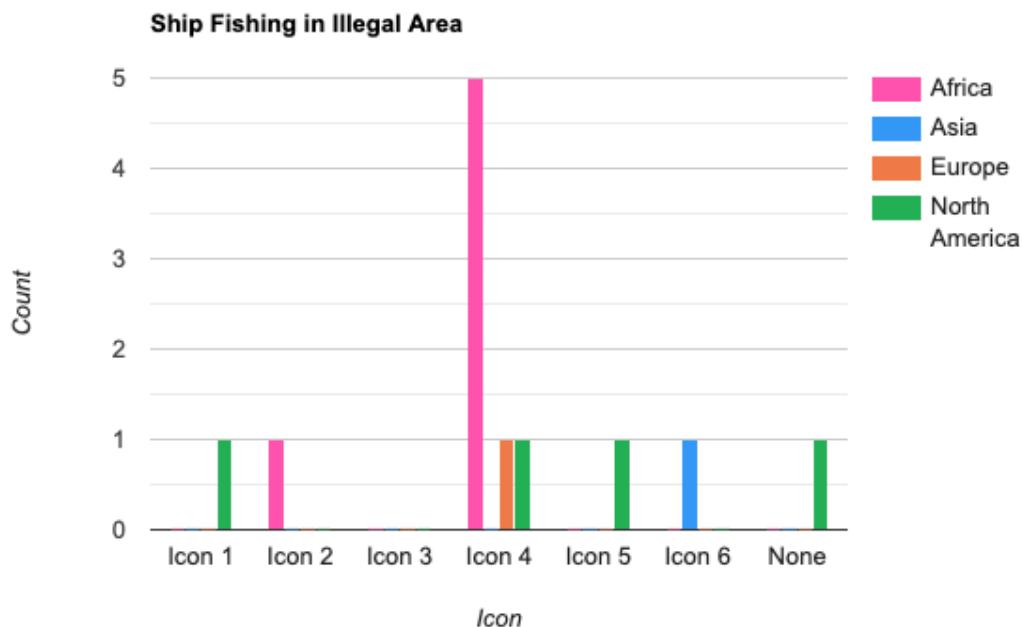


Figure 4. Participant preferences for Category 1 Ship Fishing in Illegal Area

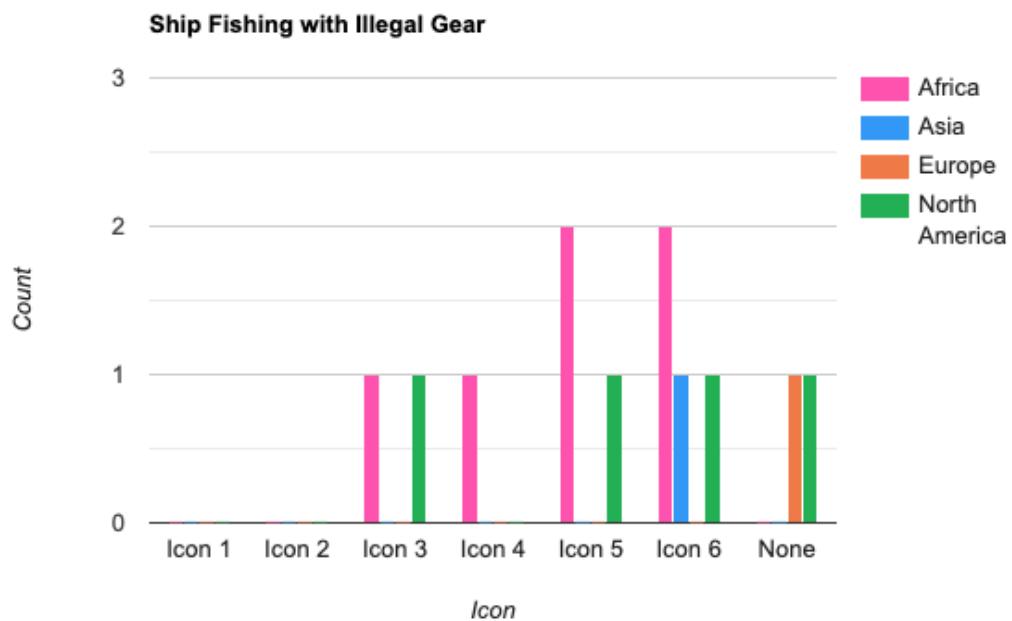


Figure 5. Participant preferences for Category 2 Ship Fishing with Illegal Gear

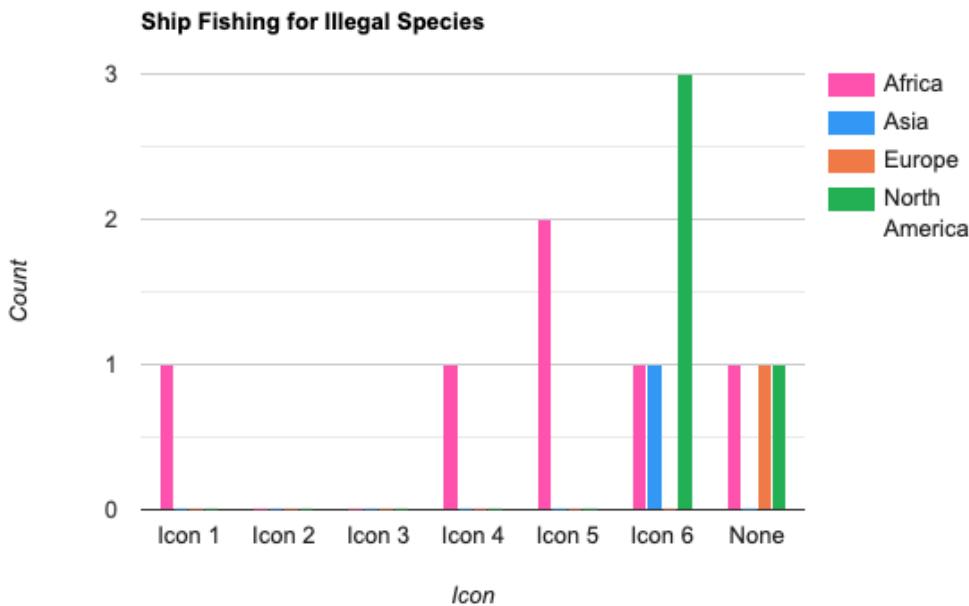


Figure 6. Participant preferences for Category 3 Ship Fishing for Illegal Species

Qualitative Results

Conducting thematic analysis on the open-ended interview data provided by participants, three overarching themes were determined.

1. *Culture/Geography*

Aligning with the trends seen in the quantitative data, there were a variety of rationales for icon rankings throughout participants. To start off, a majority of participants preferred icons with the red circle overlaid onto the images. As participant PDG stated, “Yeah I always prefer [the red circle because it] means no right? People understand that.”. However, participant H from Ghana found it confusing as the red circle with line through it means forbidden area in Ghana, and so this would be confusing to use this symbol throughout all categories. Expanding on this, although majority of users found the red circle clear to understand as it was “like the traffic signs seen while driving” (participant I) others suggested that the circle is a more

Westernized symbol and is helpful only if one knows how to drive; for the sake of those living in villages or more rural communities, participant F from Argentina recommended using an “X” icon instead.

Another predominant reason for selecting one icon over another was that participants simply selected vessel and gear icons that most resembled those seen in their areas. For example, several participants selected icon 5 for icon category 3 as it best portrayed the deep-sea trawlers participants commonly saw in their waters. This finding was further cemented with the persisting suggestion to make the vessel icons even more resemblant of the vessels participants were used to seeing, such as via adding Yamaha equipment and pair trawlers like those seen in Ghana and Sierra Leone. Regarding illegal species icons, many participants in the African countries stated that instead of a fish icon, a more intuitive animal to use would be a dolphin or turtle, which all fishermen in the area would recognize as it being illegal to fish for. However, participant P liked the use of fish as that is what is predominantly seen in Canada.

2. Information/Education

Diverging from the topic of cultural differences, another theme that arose is that of information/education. When asking participants what other component of a reporting tool would improve their user experience, the answer received time and time again was additional knowledge supplied and the app that fishers could then share with other fishers and members of the community. The knowledge requested fell into two broader categories: information for avoiding infractions and information for maintaining safety. For the former, participants suggested having lists of illegal versus legal gear types and fish species, and georeferenced regulations. Figure 7 showcases one such interface from the EU fishing coalition that displays such species lists. For the latter, information supporting safety included having weather and event updates updated by and shared amongst users.

3. Incentive

The final theme of importance was that of incentive. Determining what factors would motivate participants to use the reporting tool is vital, not only to maintain user retention but to further highlight the variation in participant experiences. For example, many North American participants described incentive to use the reporting tool as predominantly financial, such as having tax rebates or redemption on fuel costs with consistent and comprehensive use of the app (Participant SK). However, many of the fishers in Africa described the additional safety provided by the app as incentive enough. Participant S from Sierra Leone describes a common occurrence in which industrial vessels cut the nets of the local artisanal fishermen when they are sleeping. Despite these overall discrepancies between Western and non-Western participants, similar mentions of threats to safety when considering the Indigenous communities were described by participant D, with discriminatory racial overtones existing within the fishing sector due to both general lack of awareness regarding Indigenous fishing rights and the purported issue of Indigenous fishers abusing said rights.

Additional Design Suggestions

Although most participant data fell into the above 3 categories, there were also other suggestions about additional features to add to the tool that still proved valuable. Participant PDV suggested implementing a speedometer within the app that would allow the user to measure the speeds of other vessels. This could better validate suspicions of fishing, since fishing is conducted at specific speeds (Behivoke et al., 2021). The participant also cited the need for there to be a “no photo” option, in cases where the user is unable to take a photo of the incriminating vessel. In such cases, there should be an option to simply take typed notes about its appearance instead. Similarly, participant J suggested having follow-up questions for users to answer pertaining to the ship one is reporting. Questions such as “Does this ship look local or foreign?” and “Does this ship look flagged?” were examples the participant deemed as particularly applicable.

Discussion

Design Implications

Given the variability seen in icon preferences, a final selection for the icons cannot be determined with confidence. However, the importance of cultural and geographical background with respect to not only icons but desired knowledge and incentives is demonstrated by participant results. A similar study conducted by Korpi & Ahonen-Rainio (2010) came to similar conclusions with their study on semiotics with North American versus European participants, emphasizing the implication that an icon “designer should avoid de facto standards of his/her cultural environment when searching for design ideas for symbols in inter-cultural use.” Therefore, continuous research into international perspectives on symbols and their interpretations is vital in order to better understand how to select icons for such an extremely widespread user population.

The multiple suggestions related to the photo-taking component of the tool also implies that this aspect of the reporting pipeline could be more robust. That is, providing users with more agency in *how* they report a vessel, via non-photo methods like text-input and question prompts. Thus, although this tool is aimed at low-literacy populations, it should still provide the opportunity for more literate users to utilize text.

Limitations

As mentioned, due to the challenges of accessing the population of interest, the sample size was quite small and likely contributed to non-significance in quantitative results. Validating with a larger sample would be beneficial. In order to make the population more representative as well, the study should expand its participant pool to include fishers in an increased number of countries, perhaps with a focus on fishing hotspots. For example, East Asian countries such as China, Japan, and South Korea, and further African countries such as Guinea and Somalia (Belhabib & Le Billon, 2022). Regarding the interview protocol, the interview question

specifically targeting incentive was only introduced at the 6th of 12 participants, and therefore valuable input on incentive was likely missed with the previous interviews.

Future Directions

Along with a deeper investigation into cultural differences, several other options for future research exist. To start off, there is the possibility for testing different user flows and their impacts on cognitive overload. As mentioned, many fishers suggested lists of gear or species as potentially helpful additions to the reporting pipeline. However, this would also increase the complexity of the workflow which may in turn require greater mental effort from users. As found by Chaudry et al., (2012), even with an interface with a linear hierarchy, the number of errors during tasks increase with increased navigation steps or number of steps required for the given task. Better measuring the trade-off between information and cognitive overload would be a useful avenue to pursue.

Although incentive was measured in a qualitative manner throughout this study, the procedure failed to measure feelings of motivation or incentive value in an empirical manner. Therefore, it cannot be said how economic-related incentives and safety-related incentives are valued compared to one another. Quantitatively measuring such factors would provide insight into participant perceptions and how they may or may not vary with differences in culture/location.

Lastly, although there is yet to be a final design direction in terms of iconography, proceeding with the initial plan of comparing overall interface designs is still desirable, as although these designs work off of existing literature it is essential to ensure this project lands on a user flow that is intuitive and usable for our demographic in particular.

Conclusion

A language-agnostic communication tool is proposed in order to address disadvantages seen in the artisanal fishing community. Wireframe prototypes based on previously designed

low-literacy interfaces were designed, in hopes of showcasing them to small-scale fishers and other stakeholders to gain relevant opinions and feedback. The iconography for these designs, however, remain incomplete and are presently being further investigated. At present, the project's findings indicate a high amount of variability in symbol interpretations/preferences due to cultural and geographical differences, with this idea supported by semiotics research. Continuing to delve into these differences is of utmost importance in order to maximize user experience.

There is also a demand for education/information in the SSF community with this communication tool. This education/information, along with both safety and economic gain, act as potential incentives for using the tool, with cultural and geographical differences playing a role in the strength of these incentives as well.

Appendix A. Supplementary Materials

Interview Protocol/Script

General Protocol:

1. Participant will join on Zoom or other online conferencing tool; interviewer starts recording after consent form is signed
2. Interviewer will show the icons for each detail category
 - a. a ship fishing in illegal area
 - b. a ship fishing with illegal gear
 - c. a ship fishing for an illegal species
3. Ask follow-up questions
4. Interviewer will note any particular observations/answers, and also transcribe via Zoom

Script:

Hi and welcome to this study! Before we start, if you could please fill out this consent form. Please know that even when you sign, you can stop the study at any time if you feel uncomfortable, stop recording video, etc.

<Participant signs>

Awesome, thank you! And to provide details on what this study is about, I am designing a tool meant to allow fishermen to report other vessels behaving suspiciously. This means you will be able to take a photo of the boat, and then provide reasons as to why you are reporting it, and this report will be sent to the authorities. One reason for example might be an industrial vessel fishing in an artisanal area. Is this all making sense so far?

For this tool, I will be using different icons to represent these different categories for reporting vessels, so that the user will be able to choose which icons apply. And so I need the icons I use in the designs to make sense to the fishermen, such as yourself. So what you'll be doing is looking at different groups of icons and picking the ones you think are the best. If you don't like any of them, or think there could be a better one, I will ask you to draw what that would look like to you on the screen. Does this make sense? Do you have any questions before we start?

Okay, I'm going to start recording now.

<Start recording>

And to make sure it is clear what you'll be doing we will start with a practice round.

So, these icons are meant to represent hunting for sharks. Which one do you think is the best? Why?

Could you please rank these icons, with "1" being the best and "2" being the worst?

Do you think there is a better way to represent hunting sharks?

And if you ever have a better idea on what the icon should look like, I will ask you to draw a picture on the screen. If you look on the top toolbar, there will be a “draw” option letting you draw on the screen. Do you want to give that a try?

Okay, perfect. So now we are going to do that for the actual categories.

<Go through icons>

Okay, and the last thing we are going to move onto is asking you some overall questions about what you think about the study. I also really value your input about the research in general, and so if you have any opinions on the tool that you would like to mention I would love to hear them. Does this all sound ok?

Ok so first I wanted to ask:

- Q. Are there any categories not included here that you think should be included in the final design?
- Q. What other features of reporting a vessel would you want added, if any?
- Q. As a potential user, what would incentivize you to report?

<Leave this part more semi-structured; let the participant talk and provide any suggestions/experiences if they feel like it>

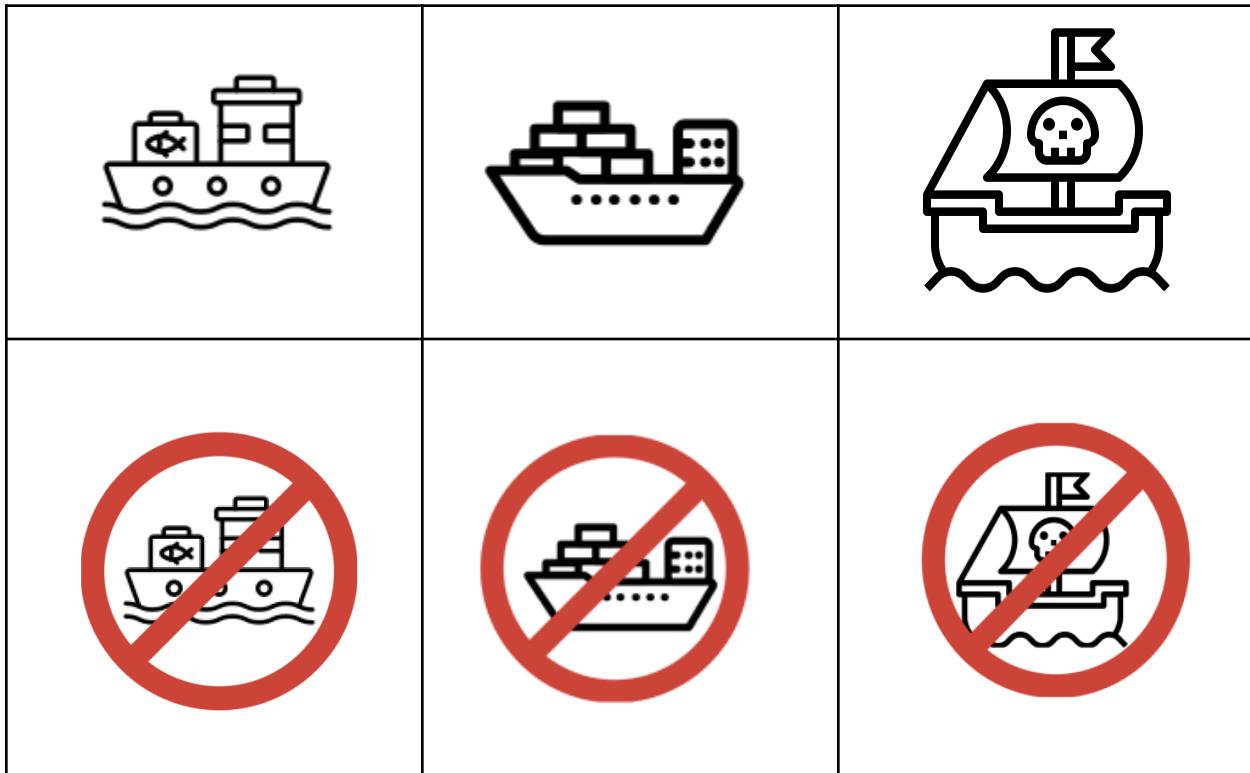
Okay, that's it! Thank you so much for participating. If at any point you would like to withdraw your data, please contact me and we will delete it. Do you have any questions before we end the study?

Ok, I'm going to stop recording now. We are all done here. If you have any follow up questions or concerns please do contact me. Thanks again.

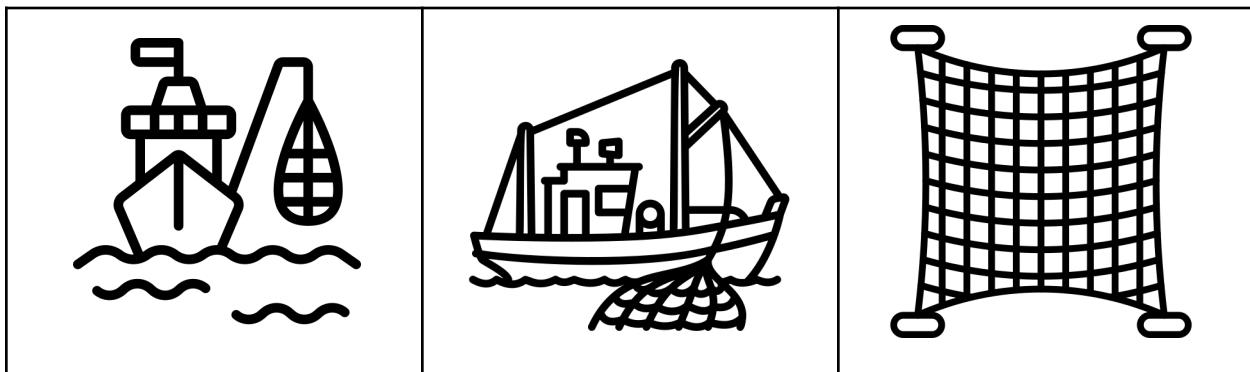
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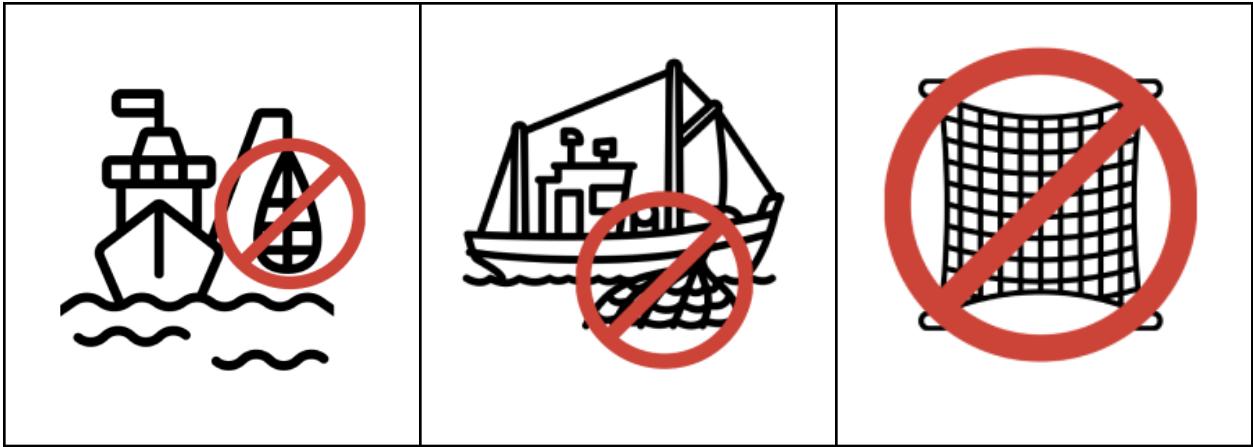
Iconography

1. A ship fishing in illegal area

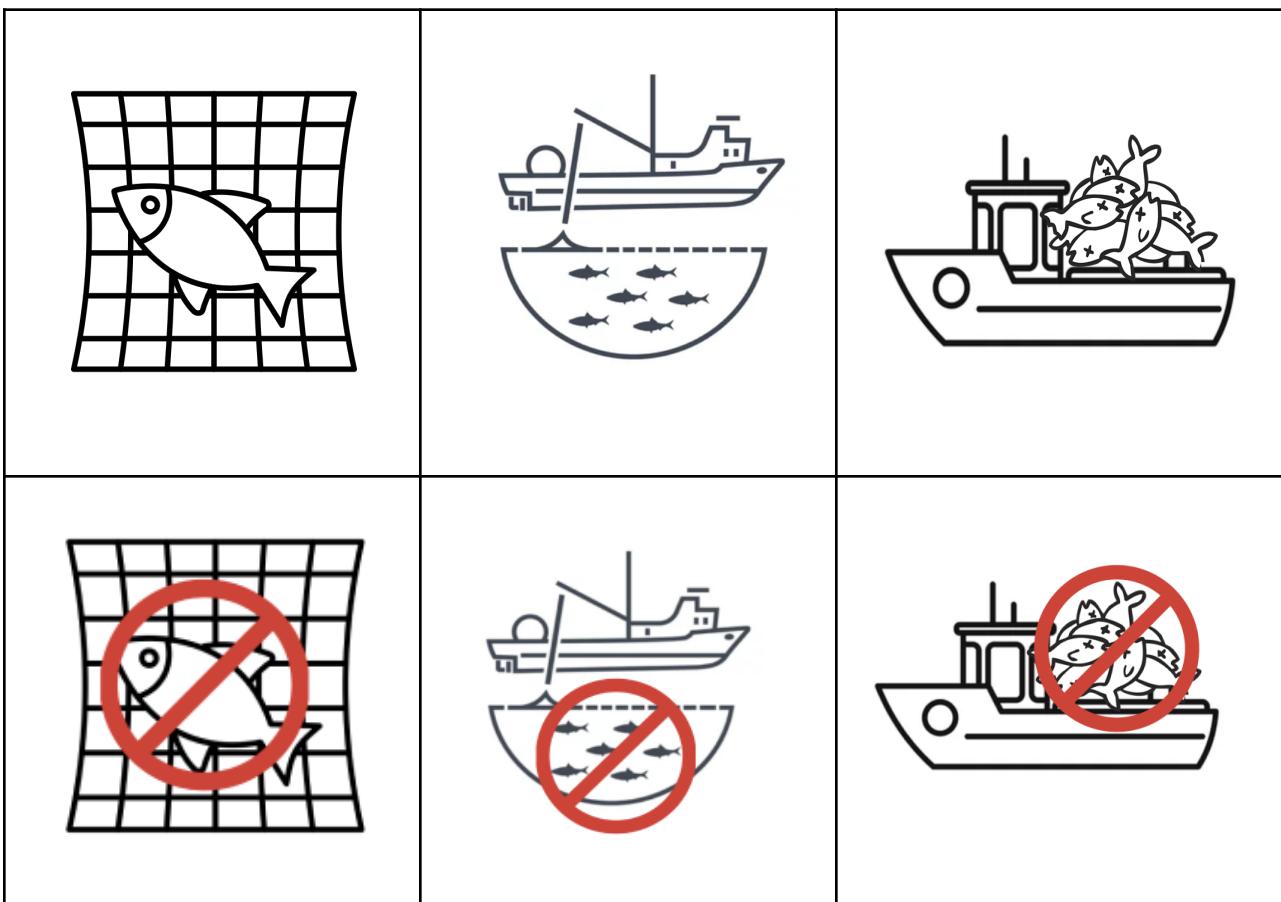


2. A ship fishing with illegal gear





3. A ship fishing for an illegal species



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