TEACHING YOU, CONSTRUCTING ME

Enabling Human-In-The-Loop Interpretability Methods of Machine Learning Models: The Case of Bird Species Identification

Project Aim

To study how to involve the end-users in the development of machine learning explainability, this project chooses the context of bird species identification. It intends to develop a platform where the end-users can learn bird knowledge while contributing to building the explainability of machine learning classification models.

Design Process

First, interviews and online surveys were conducted to better understand the birding hobbyists needs for using bird ID apps. Then, we presented the target users with explanation mock-ups to explore the opportunities of explainable AI in their learning tour. After this, we rapid-prototyped the annotation process and carried out tests, where we confirmed the end-users' capability of making accurate annotations needed by the developers. Finally, we combined the explanation and annotation parts to create gamified interfaces for a bird ID learning platform, which was tested among users and found to be engaging, enjoyable, and educational.

Classification challenge

Showing contrast between birds

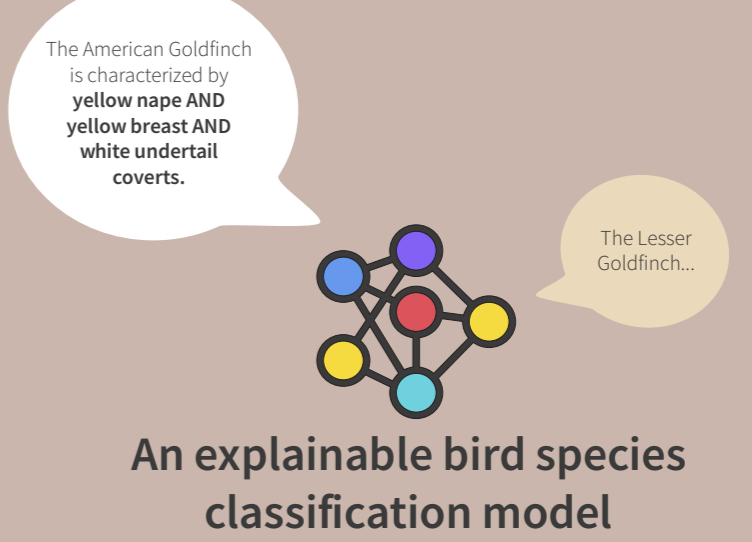**Introduction to the targe bird**
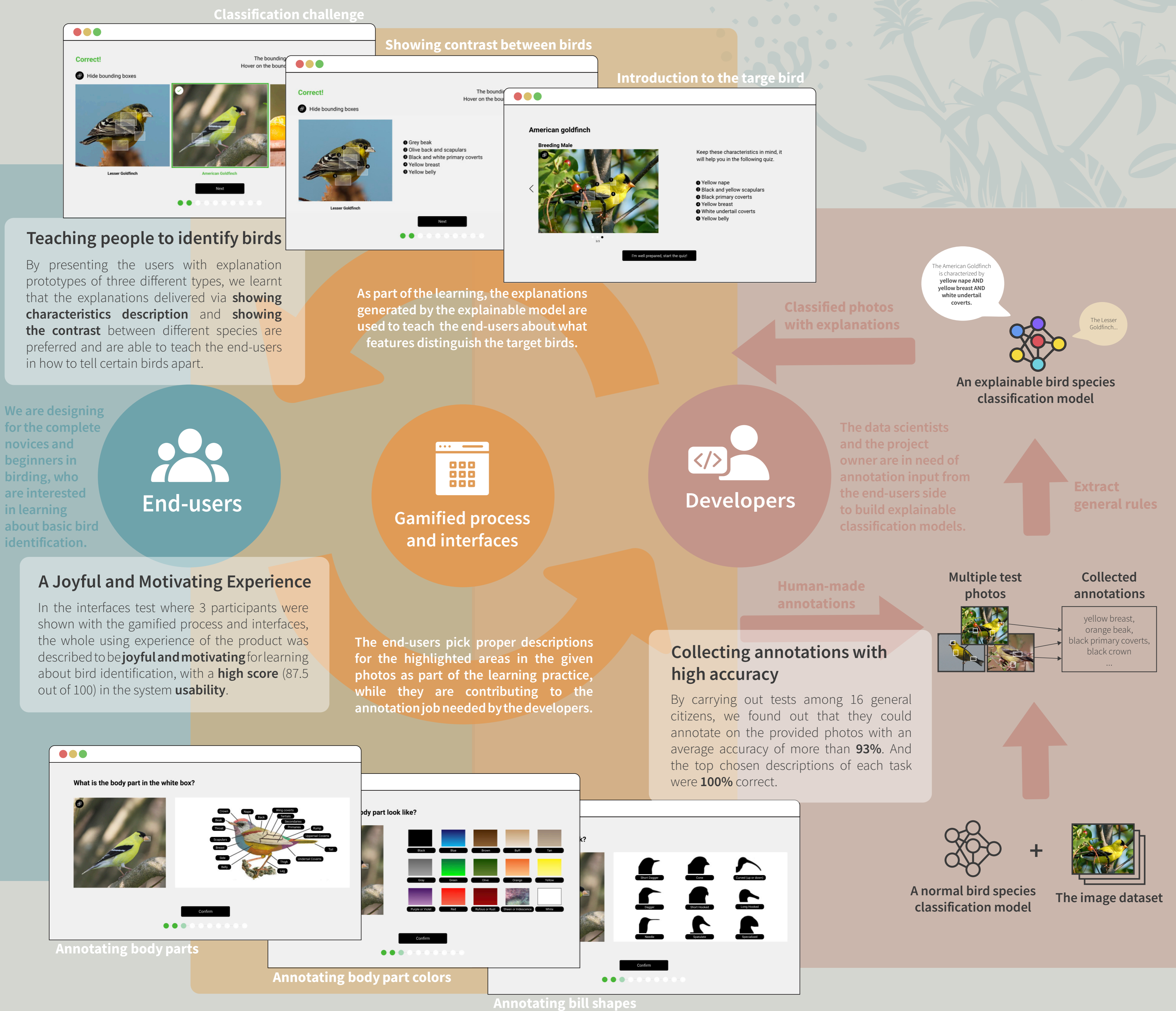
Teaching people to identify birds

By presenting the users with explanation prototypes of three different types, we learnt that the explanations delivered via **showing characteristics description** and **showing the contrast** between different species are preferred and are able to teach the end-users in how to tell certain birds apart.

As part of the learning, the explanations generated by the explainable model are used to teach the end-users about what features distinguish the target birds.

Classified photos with explanations

The American Goldfinch is characterized by yellow nape AND yellow breast AND white undertail coverts.

The Lesser Goldfinch...

An explainable bird species classification model

We are designing for the complete novices and beginners in birding, who are interested in learning about basic bird identification.

End-users

Gamified process and interfaces

Developers

The data scientists and the project owner are in need of annotation input from the end-users side to build explainable classification models.

Extract general rules

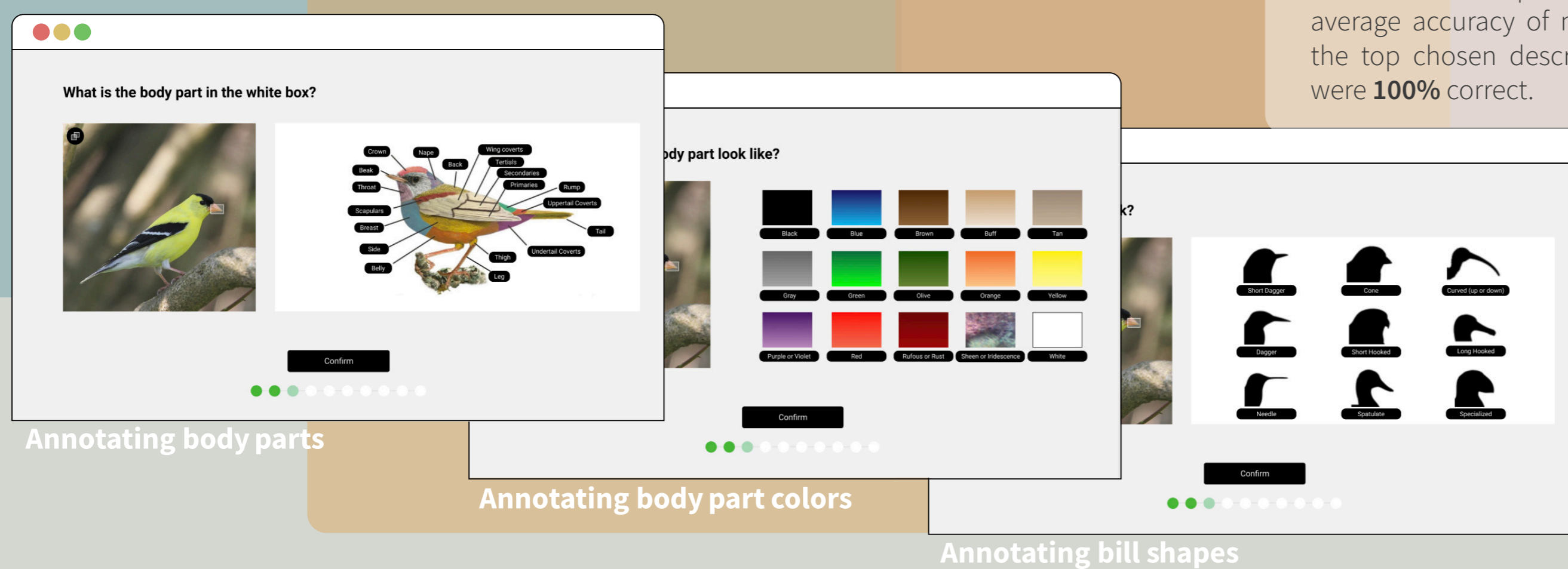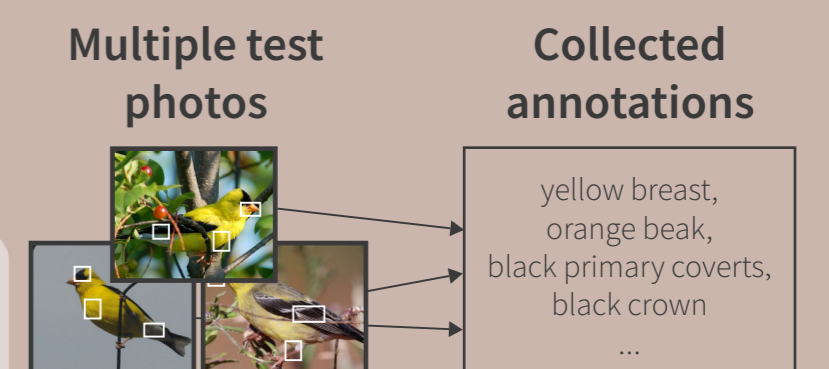## A Joyful and Motivating Experience

In the interfaces test where 3 participants were shown with the gamified process and interfaces, the whole using experience of the product was described to be **joyful and motivating** for learning about bird identification, with a **high score** (87.5 out of 100) in the system **usability**.

The end-users pick proper descriptions for the highlighted areas in the given photos as part of the learning practice, while they are contributing to the annotation job needed by the developers.

Human-made annotations

Multiple test photos

Collected annotations

yellow breast, orange beak, black primary coverts, black crown ...

Collecting annotations with high accuracy

By carrying out tests among 16 general citizens, we found out that they could annotate on the provided photos with an average accuracy of more than **93%**. And the top chosen descriptions of each task were **100%** correct.

Annotating body parts

Annotating body part colors

Annotating bill shapes

A normal bird species classification model + The image dataset

Contributions

The design research undertaken in this project shown that general citizens can be included in the creation of explainability for machine learning bird species identification models, opening up exciting new prospects for future research on human-in-the-loop explainability methods for machine learning models.

Future Opportunities

The framework we investigated in this study has the potential to be used to a broader range of applications where ML classification models are used.

Because we only used photo classification models in our study, we focused on visual-based bird identification learning. Other information, such as birds' habitats, locations, and behaviors, could be added to the existing framework as part of the learning and annotation, as birders would also like. Furthermore, in addition to annotating, we can train citizen scientists to perform more complicated tasks like classifying photographs of female or male birds using a similar approach.

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