DLfM _ Digital Libraries for Musicology
2025, Seoul. South Korea

University of Alicante, Spain
Pattern Recognition and Artificial Intelligence Group

prAig

How graphic design enables new capabilities in MuRET

Marina Maciá | marinam.ferrandez@ua.es - **David Rizo** | drizo@dlsi.ua.es - **Javier Sanchis** | javier.sanchis@ua.es

Introduction

- Musicologists face large, complex collections.
- Accuracy of Machine Learning (ML) based OMR tools constantly improving.
- **Graphical User Interfaces (GUI) lack a systematic design** methodology for leveraging all meaningful information from models *(to be presented at ICCCM)*. Current trends:
  - **Display (almost) nothing**: human-centered design (HCD) usually not considered (Fig. 2) => "Why this result?"
  - **Display everything**: blocks of explanatory text or excessive use of color, resulting in **high cognitive load** (Fig. 1).
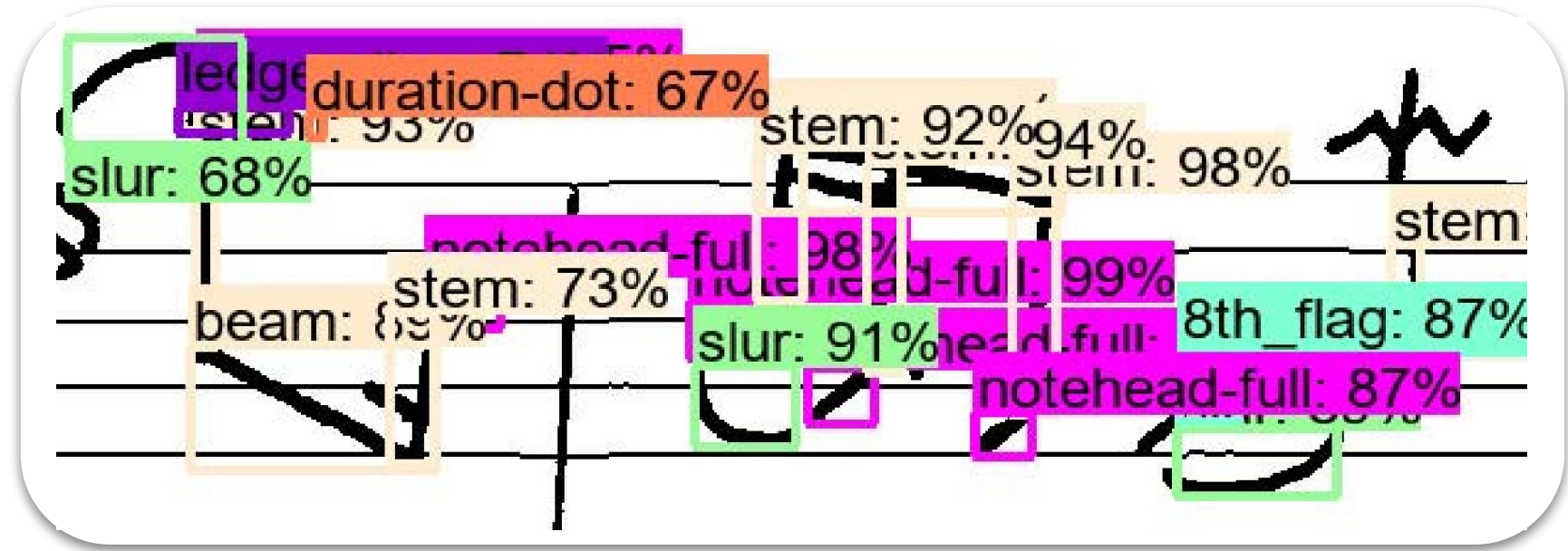

Figure 1: A. Pacha et al. (2018)

MuRET v1 tool

OMR tool for Music Recognition, Encoding, and Transcription.

- Users have pointed out that they spend most of their time finding errors.
- Developers can extract **confidence values** from the models to **guide the correction** process.

That makes this tool an ideal case study for exploring how graphic design principles could improve usability.

Figure 2: Region detection with MuRET. See repeated lyrics and empty staff

Main Objective

Systematic integration of graphic design concepts and theories into the GUI of OMR, for guiding users to smartly finding and correcting errors. This poster shows the case of Document Analysis (DA).

Hypothesis

What to address?
- Lists of suggested **next correction actions avoided** to allow different transcription **workflows**.
- **Information should be displayed** with low cognitive load, allowing the user to make their decisions.

How to do it?
- A well-designed graphical user interface improves interaction (IxD) and the overall user experience (UX).
- Early planning of the GUI during ML development is essential for defining the meaningful information of the model to be calculated.

Methodology
Less color

Double-edged resource: often overused without considering perceptual contrast ratios , color-vision deficiencies, or tool's native palettes (Fig. 3).

Multiple attributes: lightness, saturation, color harmonies, among others.

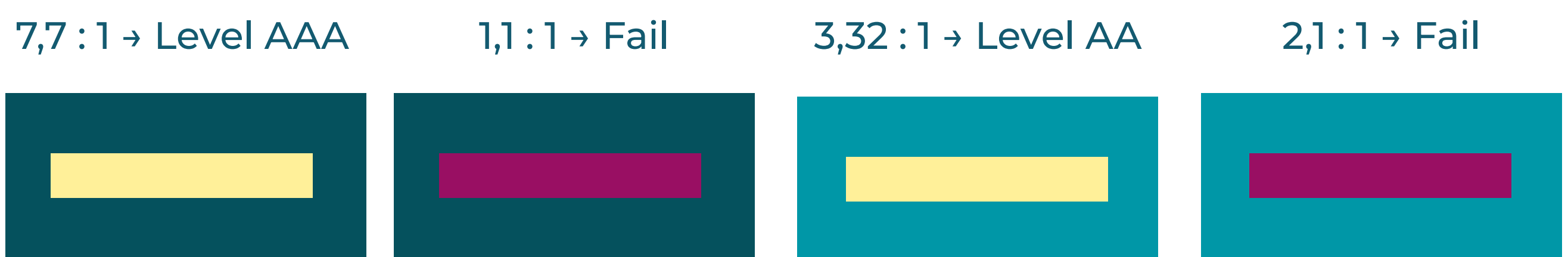7,7 : 1 → Level AAA   1,1 : 1 → Fail   3,32 : 1 → Level AA   2,1 : 1 → Fail

Figure 3: Some of the contrast tests following Web Content Accessibility Guidelines (WCAG)

Based on this contraste, the palette applied to the new UI will be a **complementary separation** of MuRET's primary blue with yellow.

Shape

A reliable visual cue that maintains its effectiveness even under color limitations through **contour**, **proportion**, **orientation**, and **spatial positioning**. It establishes hierarchy and recognition, supported by Gestalt principles.

By leveraging spatial contrast and balanced negative space, shape reinforces usability and guides intuitive navigation.

Experiment

Magnificat by Cristóbal Morales (1562), printed by Antonio Gardano, BNE / BDH M/14426.

A **nested square** for each page encodes two metrics in a compact way (Fig. below left). Vertical position denotes the, often regular, **number of staves** detected. The inner square scale reflects **detection confidence**.
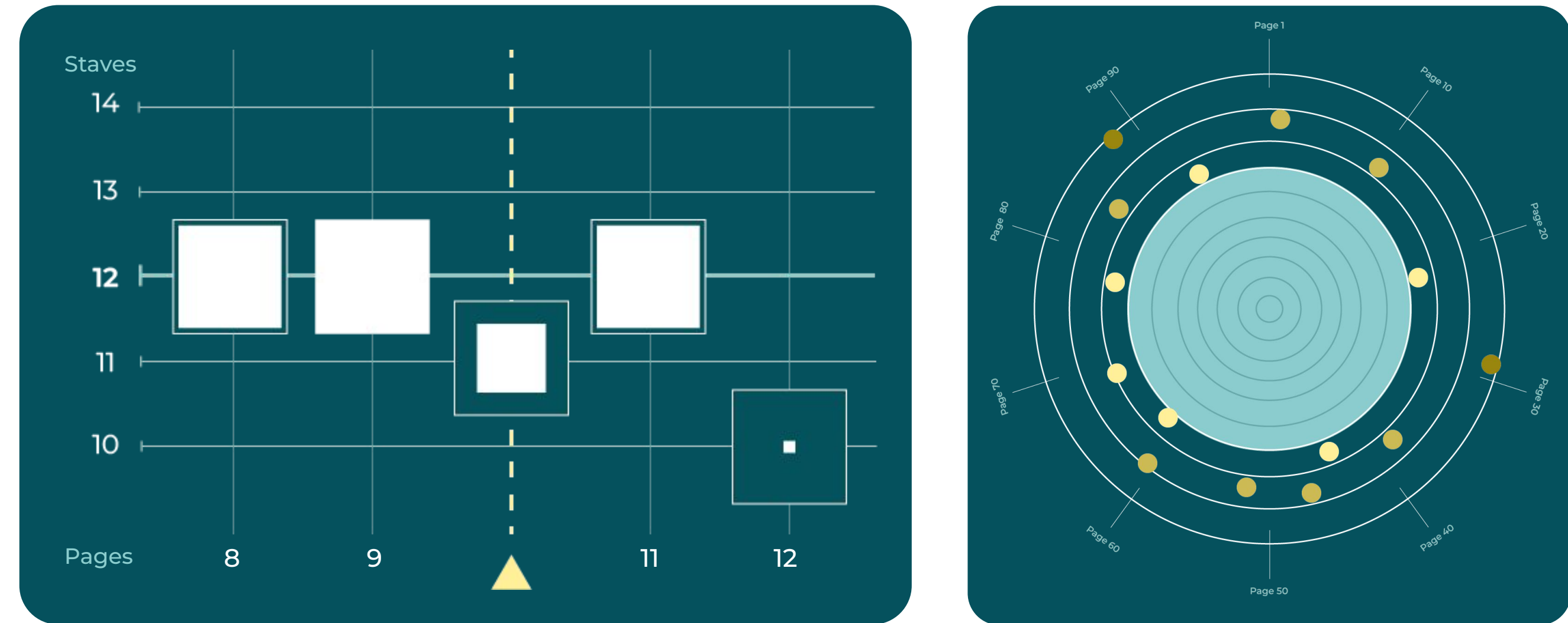
Radial plot: pages clustered by similar confidence values (Fig. above right).

- Dense inner circle represents the actual confidence threshold, approved through user actions.
- Surrounding yellow points represent pages to be assessed by the user, that may resize the confidence threshold.

Conclusion

- **Design is not just the icing on the cake**. It has a **critical factor** to leverage the potential of ML-based OMR systems.
- Human-centered design (HCD) considered from the outset of the project.
- Ongoing work: applying method to all transcription phases. Conduct user tests to evaluate the actual UX impact on the workflow.

Acknowledgements

References

M. Kurosu and K. Kashimura, Apparent usability vs. inherent usability: Experimental analysis on determinants of apparent usability, 1995.

A. Hankinson, L. Pugin, I. Fujinaga, Interfaces for document representation in digital music libraries, 2009.

M. Schedl, A. Flexer. Putting the user in the center of music information retrieval. Proc. ISMIR, 2012.

J. H. Lee, X. Hu, K. Choi, and J. S. Downie, MIREX Grand Challenge 2014 User Experience: Qualitative analysis of user feedback, in Proc. ISMIR, 2015.

A. Pacha, K. -Y. Choi, B. Coüasnon, Y. Ricquebourg, R. Zanibbi and H. Eidenberger, Handwritten Music Object Detection: Open Issues and Baseline Results, IAPR 2018.

A. Wathan, S. Schoger. Refactoring UI, 2018.

P. Knees, M. Schedl, M. Goto. Intelligent User Interfaces for Music Discovery. Transactions of the International Society for Music Information Retrieval. 3, 2020.

J. Calvo-Zaragoza, J. Hajic Jr., and A. Pacha, Understanding optical music recognition, ACM Comput. Surv., vol. 53, no. 4, 2021.

M. Miller, J. Rauscher, D. Keim, M. El-Assady. Corpusvis: Visual analysis of digital sheet music collections, 2022.

E. Isaacson. Visualizing music. Indiana University Press, 2023

D. Rizo, J. Calvo-Zaragoza, J. C. Martínez-Sevilla, A. Roselló, and E. Fuentes-Martínez, Design of a music recognition, encoding, and transcription online tool, in Proc. CMMR, 2023.

L.Dreyfus, D. Lewis, K. Page. A digital companion for musicological scholarship: the Lohengrin TimeMachine. Journal of New Music Research, 53(3–4), 297–311, 2024.

M. Grasso, M. Daquino, and G. Renda, From ontology design to user experience: A methodology to design interfaces for information seeking purposes, Umanistica Digitale, vol. 8, no. 18, 2024.

D. Rizo, J. Calvo-Zaragoza, P. García-Iasci, and T. Delgado-Sánchez, Lessons learned from a project to encode mensural music on a large scale with OMR, in Proc. ISMIR, 2024.

A. Bonde, D. Meredith. Enhancing the experience of contemporary classical music through dynamic, interactive visualisation. Music Encoding Conf., London, 2025.

Universitat d'Alacant
Universidad de Alicante

MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES

Cofinanciado por la Unión Europea

AGENCIA ESTATAL DE INVESTIGACIÓN