A Qualitative Interview Analysis on a Computer Vision-Based Chess Training Tool*

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***Abstract*—This paper will conduct a qualitative analysis of the subjective perceptions of chess players' opinions of a Computer Vision-based Chess training tool depending on their skill level.**

***Index Terms*—Computer Vision, Chess, Qualitative, Interview**

OTB Over-The-Board

I. Introduction

This paper focuses on research methodologies relevant to qualitative interview studies and will apply the best-suited approach on chess players of varying levels. Afterward, a qualitative analysis of the perceptions of the chess players' opinions on the training tool will take place.

II. Section 1

A. Description of Theme and Topic Rationale

This research will explore the opinions of chess players with respect to a computer vision-based Chess training tool that requires only a camera for in-game analysis and puzzle solving on a physical chessboard. Chess is a competitive game, in which the improvement of a player is highly dependent on the methods of which they learn it. However, most AI-driven chess assistants require digital interfaces, which limits their usability for players who prefer physical chessboards. This study will investigate how chess players at different skill levels respond to a non-intrusive, computer vision-based tool and whether they find it beneficial for learning and strategy development.

B. Positioning and Research Onion

This research falls under the interpretivist paradigm since it aims to explore the subjective experiences and perceptions of chess players regarding a computer-vision-based chess training tool. [1] describes Interpretivism as "an approach based on subjectivist ontological assumptions that entities are constituted of discourse, thus existing or socially constructed reality may be only researched through social constructions as consciousness or language". Therefore, this interview-based research will fall under the interpretivist paradigm.

This research will also follow an inductive approach, [2] describes inductive reasoning as a way of theory building that starts with a specific observation where a general rule is then formulated. Since this review seeks to develop insights from the qualitative data, the 'general rule', in this case the hypothesis, will be built after the interviews have taken place. Since this research will focus on a detailed interview with a small sample of chess players, the case study strategy has been chosen. Case studies are ideal for investigating situations within real-world settings, allowing researchers to gather rich, contextual insights. Since this study will focus on the individual player's perceptions and engagement with the training tool rather than a large-scale statistical trend study, this method will ensure a detailed exploration of personal experiences.

The methodological choice for this study will easily be the mono method. Mono method is when research only utilizes either qualitative only or quantitative only. This research will only utilize qualitative research, thus making it mono method. The time horizon of this study will be cross-sectional. Cross-Sectional time horizon is defined by [3] as "a short-term study, involving collection of data at a specific point in time." Since the interviews in this study will be captured at a single point in time, it will fall under a cross-sectional time horizon.

The techniques and procedures in this research will involve a qualitative data collection and thematic analysis. Thematic analysis is a method in qualitative research which involves identifying recurring themes, patterns, and insights from interview responses. This approach will help further uncover key factors which might influence how the tool can be improved. Some insights include perceived ease of use, accuracy, and overall usefulness in chess training.

C. Background to This Research Theme

In the present era of chess, chess engines are relied on by most digital implementations of chess. The most prominent examples of this are Chess.com and LiChess, which implement StockFish which is strongly considered the strongest chess engine as of today ([4], [5], [6]). However, this strength is not applied over casual over-the-board (OTB) chess games. The ability to recognize board positions and provide real-time feedback using only a camera presents a cheap and efficient way to integrate the strength of chess engines into OTB chess training without disrupting a player's natural learning process.

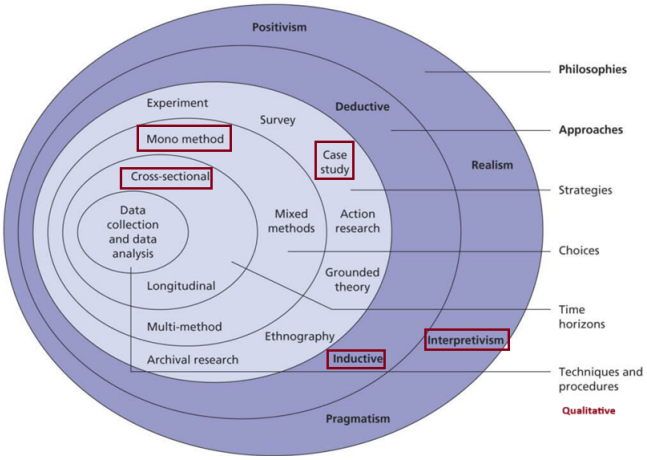

Fig. 1. Research Onion.

D. Hypothesis

1) Do chess players perceive a computer vision-based chess training tool as useful and effective for their training?
2) Is players' willingness to adopt the tool influenced by factors such as perceived ease of use, system accuracy, and integration with existing training methods?
3) Are there skill-based differences in perception, with higher-rated players being more critical of the tool's effectiveness compared to lower-rated players?

E. Research Aim and Purpose statement

The purpose of this qualitative study is to explore the perceptions of chess players at varying skill levels regarding the usability and effectiveness of a computer vision-based chess training tool. This study aims to:

1) Examine how chess players perceive the usability and effectiveness of the tool in their learning and training practices.
2) Identify key factors that influence the adoption of the tool, including ease of use, accuracy, and integration with traditional training methods.
3) Provide insights that inform the design and improvement of computer vision-based chess training tools for OTB play.

To achieve these objectives, this study will employ qualitative methods to analyse user perceptions and assess variations based on players' skill levels. Findings may contribute to the development of more effective technology-assisted training solutions for chess players.

III. Section 2

A. Research Methodology Review

In qualitative research, various methodologies are adopted to collect and analyse data. These methodologies have strengths and weaknesses; and one methodology might be stronger than the other depending on the situation. One such example is Phenomenological Research which seeks to understand individuals' lived experiences through in-depth interviews and thematic analysis [7] making a valuable methodology for exploring complex phenomena. A drawback of Phenomenological research is its reliance on subjective interpretation which introduces an element of researcher bias. Furthermore, the findings from this methodology may lack generalizability due to the small amount of sample sizes.

Grounded Theory involves data collection and analysis to develop theories grounded in empirical data in a continuous manner until either a theoretical saturation is reached, or no more information can be retrieved from additional data [8]. The flexible implementation of this methodology allows researchers to adapt their approach as new patterns emerge. However, grounded theory can be time-consuming and requires expertise to manage the iterative process effectively.

Case Study Research is used to provide a detailed exploration of a specific case through the perspective of the subjects. These specific cases can involve individuals, groups, or organizations [9]. This methodology is highly effective for understanding complex phenomena within their real-life contexts. It is particularly useful for studying unique or rare cases that cannot be captured by other methods. However similarly to Phenomenological research, case studies are often criticized for their limited ability to generalize findings beyond the studied case.

Ethnographic research is a qualitative methodology that seeks to understand social life, cultural practices, and human behavior by immersing the researcher in the natural environment of the study subjects. It employs methods such as participant observation, interviews, and archival research to gather contextualized data about a group or culture [10]. Ethnography is particularly valuable for studying marginalized groups or contexts inaccessible through other methods. However, it demands significant time and effort from researchers and poses challenges related to researcher bias and ethical considerations when interacting with participants

Narrative research focuses on understanding experiences through storytelling. It explores how individuals construct meaning from their personal or communal narratives, often emphasizing the role of context, identity, and culture in shaping these stories. This methodology is well-suited for studies involving complex social phenomena or historical perspectives. Its strength lies in revealing the depth of individual experiences and providing insights into how people make sense of their lives over time. However, narrative research can be limited by its reliance on subjective accounts and may struggle with issues of validity when comparing narratives across different contexts [11].

Academic materials, such as peer-reviewed journal articles, conference papers, and scholarly books, undergo rigorous evaluation by experts in the field. These sources provide credible and validated insights into research methodologies. In contrast, non-academic sources, including blogs, news articles, and opinion pieces, lack systematic peer review and may present biased or anecdotal evidence. While non-academic materials can provide contextual background, they should not be the primary basis for academic research. ([7], [8], [9], [10],

[11]) provide insights into qualitative research methodologies and their applications.

In qualitative interview research, scholars have explored various interview techniques, including structured, semi-structured, and unstructured interviews. The choice of technique depends on research objectives. For instance, semi-structured interviews allow flexibility while ensuring consistency in questioning, making them ideal for studies exploring personal experiences [12]. Moreover, previous studies have demonstrated that qualitative interviews provide rich, in-depth insights that cannot be easily captured through quantitative methods [13].

[14] criticizes qualitative interviews for their subjectivity, this is because researchers' interpretations of the data retrieved may accidentally shape findings. [15] counters this by mentioning that interpretive flexibility allows for capturing nuances missed by quantitative methods; further underscoring the need for reflexivity in qualitative designs. A few knowledge gaps which were noticed from existing literature is the limited exploration of the effects of interviewers on participant responses, and ethical considerations when retrieving data from named subjects, which warrants further investigation.

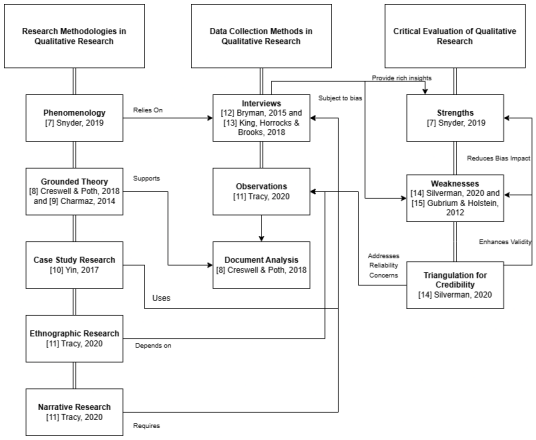

Fig. 2. Literature Map.

IV. Section 3

A. Research Questions

The key research questions this study seeks to answer are:

1) Do chess players perceive a computer vision-based chess training tool as useful and effective for their training?
2) Is the willingness of players to adopt the tool influenced by factors such as perceived ease of use, system precision, and integration with existing training methods?
3) Are there skill-based differences in perception, where players with higher Elo rating are more critical of the effectiveness of the tool compared to those with a lower rating?

B. Research Objectives

To answer the previous research questions, this study will adopt the following:

1) Examine how chess players perceive the usability and effectiveness of the tool in their learning and training practices.
2) Identify key adoption factors, including ease of use, accuracy, and integration with traditional training methods.
3) Analyze the differences in perception and approaches to the tool between the higher rated and lower rated players.
4) Provide insights for improving computer vision-based chess training tools to support OTB play.

C. Philosophies, Approaches and Paradigms

The research employs an Inductive approach, whilst also answering already defined hypothesis created specifically to guide the research focus. Whilst there are already pre-defined hypothesis, it is important to note that these are more-so assumptions rather than fixed theories. Therefore, it is expected that new hypothesis may emerge from the qualitative interviews and thematic analysis.

The chosen research strategy is a Case Study, allowing for an in-depth examination of each participants' observations of the training tool, whilst also going into depth of the perceptions unique to players of their skill level.

As mentioned before, the best suited paradigm for this study is the Interpretivist paradigm since the focus will be on the participants' interpretation of the Chess training tool which is affected by their individual experience of Chess. The reason this paradigm will be applied is because the results achieved from the interview is the interpretation of the participants of the perceived chess training tool.

D. Chosen Methodology, Experiment Design, and Analysis

For this study, a qualitative, mono-method, and cross-sectional approach is most appropriate. This study will employ two semi-structured, case study style interviews on two chess players with significantly different skill levels; one beginner player (700 Elo), and one experienced player (1600 Elo, also active in a chess club). A semi-structured interview will allow the flexibility needed to gather insights unique to the level of the player, whilst also ensuring consistency in key themes to further highlight the difference of perception between differently skilled players ([12], [13], [3]). Employing the case study strategy will enable an in-depth exploration of the chess players' opinions and perceptions of the tool, best fitting the requirements to answer the research questions of this study.

Since the focus of this study will be not only on the individual perceptions of the chess players, but also the differences of their perceptions, a thematic analysis will be applied to the collected data to identify any recurring patterns and themes [11]. Thematic analysis will also help uncover the perceptions of the tool's usability, effectiveness, and the key factors influencing its adoption. By categorizing these

responses, a structured interpretation of the results will be retrieved from the semi-structured approach of the interview.

E. Reflections on Validity, Reliability and Generalizability/Transferability

1) Validity: To ensure credibility, this study will involve careful review of interview transcripts to accurately reflect participant responses [14]. Given the different skill levels of the two participants, particular attention will be paid to identifying consistent or contrasting themes in their perspectives. Hopefully This approach will ensure that the findings genuinely capture their views without misinterpretation.

2) Reliability: Since this study involves only two participants, the small sample size will definitely limit the reliability of the findings. It is worth appreciating that the perspectives of a single 1600-rated player will not necessarily represent the opinions of all experienced chess players, just as the beginner's perspectives cannot encapsulate the views of all lower-rated players. While a structured coding framework can ensure consistency in analyzing responses ([15], the limited number of participants means that results should be interpreted as individual perspectives rather than broadly applicable insights.

3) Generalizability/Transferability: Although this study cannot necessarily aim for statistical generalizability due to the small sample size. The case study strategy will provide in-depth, contextual insights rather than broad, universally applicable conclusions. Therefore whilst having reduced generalizability, transferability can still be achieved by providing thick descriptions of the study context, methodology, and findings. This will allow future researchers to determine whether the insights gained could still be applicable to their own research, therefore not completely voiding the results achieved.

F. Ethical Considerations

1) Informed Consent: Participants will be fully informed about the study's purpose, their voluntary participation, and their right to withdraw at any time. Explicit consent will be obtained for using their Elo ratings, ensuring they understand how their data will be presented.

2) Privacy and Data Protection: While Elo ratings on a digital platform such as Chess.com may be publicly available, their inclusion in this study will require participant approval. If preferred, data can be anonymized, and all collected information, including interview transcripts, will be securely stored and accessed only by authorized individuals.

3) Accuracy and Representation: Elo ratings fluctuate and may not fully represent a player's skill. This study will verify and report ratings accurately while acknowledging their limitations, ensuring that conclusions are not misrepresented.

4) Ethical Publishing and Reporting: Findings will be presented respectfully, avoiding any potential harm, misrepresentation, or embarrassment to participants. If a participant decides to retract their shared data, their request will be honored.

5) Institutional and Legal Compliance: If required, ethical approval will be obtained from relevant academic bodies, and all data handling will comply with applicable data protection regulations.

G. Units

- Use either SI (MKS) or CGS as primary units. (SI units are encouraged.) English units may be used as secondary units (in parentheses). An exception would be the use of English units as identifiers in trade, such as "3.5-inch disk drive".
- Avoid combining SI and CGS units, such as current in amperes and magnetic field in oersteds. This often leads to confusion because equations do not balance dimensionally. If you must use mixed units, clearly state the units for each quantity that you use in an equation.
- Do not mix complete spellings and abbreviations of units: "Wb/m^2" or "webers per square meter", not "webers/m^2". Spell out units when they appear in text: ". . . a few henries", not ". . . a few H".
- Use a zero before decimal points: "0.25", not ".25". Use "cm^3", not "cc".)

H. Equations

Number equations consecutively. To make your equations more compact, you may use the solidus (/), the exp function, or appropriate exponents. Italicize Roman symbols for quantities and variables, but not Greek symbols. Use a long dash rather than a hyphen for a minus sign. Punctuate equations with commas or periods when they are part of a sentence, as in:

$$a + b = \gamma \tag{1}$$

Be sure that the symbols in your equation have been defined before or immediately following the equation. Use "(1)", not "Eq. (1)" or "equation (1)", except at the beginning of a sentence: "Equation (1) is . . ."

I. LaTeX-Specific Advice

Please use "soft" (e.g., `\eqref{Eq}`) cross references instead of "hard" references (e.g., `(1)`). That will make it possible to combine sections, add equations, or change the order of figures or citations without having to go through the file line by line.

Please don't use the `{eqnarray}` equation environment. Use `{align}` or `{IEEEeqnarray}` instead. The `{eqnarray}` environment leaves unsightly spaces around relation symbols.

Please note that the `{subequations}` environment in LaTeX will increment the main equation counter even when there are no equation numbers displayed. If you forget that, you might write an article in which the equation numbers skip from (17) to (20), causing the copy editors to wonder if you've discovered a new method of counting.

BibTeX does not work by magic. It doesn't get the bibliographic data from thin air but from .bib files. If you use BibTeX to produce a bibliography you must send the .bib files.

LaTeX can't read your mind. If you assign the same label to a subsubsection and a table, you might find that Table I has been cross referenced as Table IV-B3.

LaTeX does not have precognitive abilities. If you put a `\label` command before the command that updates the counter it's supposed to be using, the label will pick up the last counter to be cross referenced instead. In particular, a `\label` command should not go before the caption of a figure or a table.

Do not use `\nonumber` inside the `{array}` environment. It will not stop equation numbers inside `{array}` (there won't be any anyway) and it might stop a wanted equation number in the surrounding equation.

J. Some Common Mistakes

- The word "data" is plural, not singular.
- The subscript for the permeability of vacuum μ_0, and other common scientific constants, is zero with subscript formatting, not a lowercase letter "o".
- In American English, commas, semicolons, periods, question and exclamation marks are located within quotation marks only when a complete thought or name is cited, such as a title or full quotation. When quotation marks are used, instead of a bold or italic typeface, to highlight a word or phrase, punctuation should appear outside of the quotation marks. A parenthetical phrase or statement at the end of a sentence is punctuated outside of the closing parenthesis (like this). (A parenthetical sentence is punctuated within the parentheses.)
- A graph within a graph is an "inset", not an "insert". The word alternatively is preferred to the word "alternately" (unless you really mean something that alternates).
- Do not use the word "essentially" to mean "approximately" or "effectively".
- In your paper title, if the words "that uses" can accurately replace the word "using", capitalize the "u"; if not, keep using lower-cased.
- Be aware of the different meanings of the homophones "affect" and "effect", "complement" and "compliment", "discreet" and "discrete", "principal" and "principle".
- Do not confuse "imply" and "infer".
- The prefix "non" is not a word; it should be joined to the word it modifies, usually without a hyphen.
- There is no period after the "et" in the Latin abbreviation "et al.".
- The abbreviation "i.e." means "that is", and the abbreviation "e.g." means "for example".

An excellent style manual for science writers is [**?**].

K. Authors and Affiliations

The class file is designed for, but not limited to, six authors. A minimum of one author is required for all conference articles. Author names should be listed starting from left to right and then moving down to the next line. This is the author sequence that will be used in future citations and by indexing services. Names should not be listed in columns nor group by affiliation. Please keep your affiliations as succinct as possible (for example, do not differentiate among departments of the same organization).

L. Identify the Headings

Headings, or heads, are organizational devices that guide the reader through your paper. There are two types: component heads and text heads.

Component heads identify the different components of your paper and are not topically subordinate to each other. Examples include Acknowledgments and References and, for these, the correct style to use is "Heading 5". Use "figure caption" for your Figure captions, and "table head" for your table title. Run-in heads, such as "Abstract", will require you to apply a style (in this case, italic) in addition to the style provided by the drop down menu to differentiate the head from the text.

Text heads organize the topics on a relational, hierarchical basis. For example, the paper title is the primary text head because all subsequent material relates and elaborates on this one topic. If there are two or more sub-topics, the next level head (uppercase Roman numerals) should be used and, conversely, if there are not at least two sub-topics, then no subheads should be introduced.

M. Figures and Tables

a) Positioning Figures and Tables: Place figures and tables at the top and bottom of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table heads should appear above the tables. Insert figures and tables after they are cited in the text. Use the abbreviation "Fig. 2", even at the beginning of a sentence.

TABLE I
TABLE TYPE STYLES

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[a]Sample of a Table footnote.

ACKNOWLEDGMENT

The preferred spelling of the word "acknowledgment" in America is without an "e" after the "g". Avoid the stilted expression "one of us (R. B. G.) thanks ...". Instead, try "R. B. G. thanks...". Put sponsor acknowledgments in the unnumbered footnote on the first page.

REFERENCES

Please number citations consecutively within brackets [**?**]. The sentence punctuation follows the bracket [**?**]. Refer simply to the reference number, as in [**?**]—do not use "Ref. [**?**]" or "reference [**?**]" except at the beginning of a sentence: "Reference [**?**] was the first ..."

Number footnotes separately in superscripts. Place the actual footnote at the bottom of the column in which it was

cited. Do not put footnotes in the abstract or reference list. Use letters for table footnotes.

Unless there are six authors or more give all authors' names; do not use "et al.". Papers that have not been published, even if they have been submitted for publication, should be cited as "unpublished" [**?**]. Papers that have been accepted for publication should be cited as "in press" [**?**]. Capitalize only the first word in a paper title, except for proper nouns and element symbols.

For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [**?**].

N. Abbreviations and Acronyms

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, ac, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

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