Visualizing Financial Futures: Enhancing Accessibility and Engagement Through Interactive Collaboration

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This position paper examines how interactive visualization can democratize financial planning amid significant socio-economic shifts. Aging populations, inflation, and changing labor markets increase pressure on social systems and therefore shift financial responsibility to individuals. This has emphasized both the complexity and the importance of financial products. We identify three interrelated challenges: reducing cognitive complexity through visual abstraction and the promotion of financial literacy, enhancing accessibility through interactive representations tailored to diverse learning styles, and facilitating collaborative engagement through shared visualization spaces. Moving beyond traditional approaches focused solely on comprehension, we argue for addressing emotional factors such as self-efficacy, subjective complexity, and anxiety that influence financial decision-making. This research direction contributes to making financial technologies more inclusive, particularly for marginalized populations, by bridging knowledge gaps and enabling more effective financial planning.

Additional Key Words and Phrases: Fintech, Financial Literacy, Poverty, Information visualization, Interaction Design

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1 Introduction

This position paper examines how interactive visualization of financial data can address growing challenges in financial planning amid significant socio-economic changes. An aging society, rising inflation [2], and evolving labor markets throughout the EU [9] have increased pressure on social systems while shifting financial responsibility more to individuals [12]. Simultaneously, the rapid emergence of fintech [10, 19] has exponentially expanded investment opportunities, leading to a paradoxical situation: more choices, but also more responsibility for financial outcomes. In this environment, a critical issue becomes apparent:

The established connection between financial literacy and financial resilience demonstrates that the accessibility and comprehensibility of financial products are increasingly important [8, 17]. As both products and decision-making become more complex, many people face significant barriers to effective financial planning, particularly those from marginalized or vulnerable populations.

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2 Framework and related work

We propose that interactive visualization offers a promising approach to democratizing financial planning by addressing three interconnected challenges:

2.1 Reducing Complexity Through Visual Abstraction

Interactive visualization of financial information has received increasing attention in recent years; visualization was utilized to promote understanding of financial data through abstract representation of (interactive) graphs [4, 16, 22, 26, 27, 29], or in some cases utilizing metaphorical representations to explain underlying concepts [18, 24]. Research has focused on supporting understanding related to financial literacy and improving decision-making processes for both experts and the general public.

Visualization of quantitative information can improve accuracy and response time by reducing cognitive load [7] and facilitating contextual understanding [23], thereby increasing awareness and promoting financial literacy. However, understanding is only one aspect, unless one assumes the existence of homo economicus [32]. This normative model from behavioral economics has been increasingly questioned, as research demonstrates that non-cognitive factors such as culture or emotions [28], the inherent use of heuristics and influence of biases [30], and framing effects [31] influence rational action. Consequently, facilitating effective financial decisions requires consideration of both cognitive and non-cognitive effects, e.g.:

- Visual representation can enhance comprehension through improved information processing, though effectiveness varies depending on complexity, user expertise, and specific visual formats.[7, 11]
- Visual representation can trigger and / or amplify biases, which must be considered appropriately during the development and evaluation of visualization approaches, as they influence the way financial information will be assessed[3, 6, 7].
- Information visualization methods can influence emotional responses and attitudes such as anxiety or fear [21] or risk attitude [7] which affect both understanding[20] and action [5].
- Interactive visualization can impact self-efficacy [15, 16], which can increase the willingness to adopt fintech services [14]. As perceived competence can influences both action intentions as well as subjective assessment of skills, financial decisions require a good balance between self-confidence, motivation, and understanding. These factors must be considered when developing interactive visualization methods, as both visualization and interactivity can have an effect on calibration [7, 29].

Given these complex cognitive and emotional dynamics, it is essential to carefully design and evaluate financial visualization tools that promote both understanding and appropriate confidence levels. This is particularly relevant in contexts that involve vulnerable population groups, low financial literacy, or new application areas. When poorly implemented, visualization approaches may inadvertently create misalignment between perceived and actual competence, potentially leading to suboptimal financial choices. Therefore, we need to better understand how these effects are caused and can be potentially mitigated or used so that more options do not lead to increased risks, allowing financially sound interaction.

2.2 Enhancing Accessibility Through Interactive Representations

Recent research has investigated various forms of interaction with financial data, particularly in regard to improved accessibility in regard to understanding and financial literacy [16, 22, 23, 25, 27, 29]. The impact of interaction on developing financial competence, contextual understanding, and individual financial decisions requires critical examination:

Individual financial planning typically involves evaluating dynamic future scenarios where financial decisions align with life choices (e.g. borrowing more money, working more or less, starting a family). Interaction allows users to simulate and compare different scenarios, thus improving accessibility, engagement, and comprehension [16, 22, 23, 29]. However, the quality and implications of financial planning depend not only on understanding fundamental financial concepts, personal motivation, and self-efficacy but critically on realistic assessment of potential consequences. Notably, the combination of visualization and interaction can influence investment willingness [1, 29].

Tang et al. [29] observed that visualization and interaction can increase subjective confidence independently with potential negative effects on calibration, whereby the combination of visualization and interaction improved calibration and therefore led to an increased decision accuracy.

To promote the impact of competence on behavior, e.g., to support the financial resilience of individuals, it appears beneficial to integrate interaction directly into decision-making situations. Interactive and emotional feedback mechanisms meaningfully integrated into purchasing decision processes not only develop better financial awareness, but also stimulate individual behavioral adaptation [13].

The underlying assumption that interactivity can improve understanding, decision quality, and behavior is dependent on various user-specific factors such as domain knowledge, experience, digital literacy, and individual preferences for financial information processing. Against this background, interactive visualizations that consider different learning styles and abilities can significantly improve accessibility for diverse user groups. Additionally, it appears reasonable to measure the effects of stimuli and interaction both in their interrelationship and on an individual basis in order to better understand the underlying mechanisms.

2.3 Collaborative Engagement Through Shared Visualization Spaces

Most approaches focus on individual interaction, whereas collaborative approaches—such as those involving different knowledge levels e.g. in an advisory or educational contexts—appear particularly valuable for financial planning and/or complex financial products and concepts. These situations often involve an asymmetry of knowledge, and to develop meaningful systems in this context, the insights from points 2.1 and 2.2 must be effectively connected to ensure accessibility as well as efficient communication and interaction. Shared visualization spaces can facilitate interpersonal financial discussions and bridge knowledge gaps between experts and novices. They could integrate various types of financial data, including income streams, investment portfolios, debt obligations, and spending patterns, enabling cooperative financial planning processes within personalized contexts. Visualization and interaction methodologies must be calibrated to align with the financial literacy and visual comprehension capabilities of individual stakeholders. Although collaborative financial planning is unified by underlying financial concepts and foundational data structures, it seems very likely that interaction requirements and complexity thresholds will demonstrate significant heterogeneity across the different actors. Data visualizations should dynamically adjust complexity levels based on the individual literacy level (e.g., using more metaphoric representation to support audiences with low literacy or showing simplified growth curves for novices while providing detailed risk metrics for experts). A collaborative financial planning might include a multi-user interface where financial advisors and individuals could simultaneously interact with the same

dataset, such as retirement portfolio projections, simulating the impact of individual life choices like early retirement, reducing working hours, a marriage or divorce to reflect the long-term financial effects of the individual decisions. Another example could be a family budget planning tool in which household members can collaboratively view spending patterns across different categories, each member able to propose and visualize the impact of different spending adjustments on the overall household budget. Feedback mechanisms like visual tools to monitor budgets, tactile or auditory feedback on spending in situations where expenditures are made, e.g., while shopping, can increase awareness of spending patterns. Furthermore, the resulting social component can support financially sustainable behavior as a shared environment integrates all household members and helps increase financial literacy, particularly among children.

3 Conclusion

The increasing complexity of financial products and shifting socioeconomic landscapes necessitate new approaches to financial planning and education. Interactive visualization presents a powerful tool to address these challenges by reducing cognitive barriers, enhancing accessibility, and enabling collaborative decision-making. However, to maximize its potential, we must move beyond mere comprehension to address emotional factors that influence financial decisions. Future research should explore the interplay between visual representation, emotional responses, and financial behaviors, particularly focusing on how interactive visualizations can empower marginalized populations. Additionally, developing frameworks for collaborative financial planning through shared visualization spaces could help bridge knowledge gaps and democratize access to financial literacy. By integrating insights from HCI, behavioral economics, and visual analytics, we can create more inclusive and effective financial technologies that respond to the evolving needs of diverse populations in uncertain economic times.

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