

Towards Making Your VIS Paper Writing Better”

Presenter: Shaolun RUAN

12/15/23

Towards Making Your VIS Paper Writing Better

Before We Start

Thank Prof. Jiansu PU for inviting me here!



Towards Making Your Vision Before We

I spent the unfor



Hi there!

Hi, I'm Shaolun Ruan

I am currently a Ph.D. candidate of Computer Science at [Singapore Management University](#), under the supervision of Professor [Yong WANG](#). Before that, I received my bachelor degree from [University of Electronic Science and Technology of China](#) at School of Computer Science and Engineering in 2019. From 2020 to 2021, I worked as a Research Assistant at Kent State University, U.S.

I develop novel graphical representations that enable a more effective and smoother analysis using machines. My work focuses on handling complex domain problems in *quantum computing*, leveraging the methods from **Data Visualization** and **Human-computer Interaction**.



My Research

- **TVCG 2023** [VIOLET: Visual Analytics for Explainable Quantum Neural Networks](#), Shaolun Ruan, Zhiding Liang, Qiang Guan, Paul Griffin, Xiaolin Wen, Yanna Lin, and Yong Wang *IEEE Transactions on Visualization and Computer Graphics (TVCG 2023)*.
- **TVCG 2023** [QuantumEyes: Towards Better Interpretability of Quantum Circuits](#), Shaolun Ruan, Qiang Guan, Paul Griffin, Ying Mao, and Yong Wang, *IEEE Transactions on Visualization and Computer Graphics (TVCG 2023)*.
- **TVCG 2022** [VACSEN: A Visualization Approach for Noise Awareness in Quantum Computing](#), Shaolun Ruan, Yong Wang, Weiwen Jiang, Ying Mao, Qiang Guan, *IEEE Transactions on Visualization and Computer Graphics (TVCG 2022)*.
- **EuroVis 2023** [VENUS: A Geometrical Representation for Quantum State Visualization](#), Shaolun Ruan, Ribo Yuan, Qiang Guan, Yanna Lin, Ying Mao, Weiwen Jiang, Zhepeng Wang, Wei Xu, Yong Wang, *Computer Graphics Forum (Proceedings of EuroVis 2023)*.
- **VIS 2023** [Intercept Graph: An Interactive Radial Visualization for Comparison of State Changes](#), Shaolun Ruan, Yong Wang, Qiang Guan, *Proceedings of IEEE VIS (VIS 2021)*.
- **DATE 2023** [BatchLens: A Visualization Approach for Analyzing Batch Jobs in Cloud Systems](#), Shaolun Ruan, Yong Wang, Hailong Jiang, Weijia Xu and Qiang Guan, *Proceedings of Design, Automation and Test in Europe Conference (DATE 2022)*.
- **PRDC 2023** [Visilience: An Interactive Visualization Framework for Resilience Analysis using Control-Flow Graph](#), Hailong Jiang*, Shaolun Ruan*, Bo Fang, Yong Wang, and Qiang Guan, *Proceedings of IEEE PRDC 2023*.

Agenda

- **Think about the “writing space”**
- **Set the tone making your paper “can be accepted”**
- **What does a VIS-tier figure look like?**
- **Do everything before the April 1st**

Papers - Call For Participation

In 2021, IEEE VIS transitioned from the three sub-conferences (VAST, InfoVis, and SciVis) to one unified conference. IEEE VIS 2023 solicits novel research contributions and innovative applications in all areas of visualization.

Area 1: Theoretical & Empirical
This area focuses on theoretical and empirical research topics that aim to establish the foundation of VIS as a scientific subject.

Area 2: Applications
This area encourages submissions of application-focused research that demonstrate how visualization can be used to solve real-world problems.

Area 3: Systems & Rendering
This area focuses on the themes of building systems, algorithms for rendering, and alternative input and output modalities.



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Think about the “writing space”



VIS PROGRAM →
See the complete conference program

Papers

The latest research in theory, methods, and applications of visualization
Posters
Nascent and recent work

Tutorials

Learn new tools and application domains
Workshops
Informal setting to discuss emerging topics

Panels

Discuss important topics in the field



Program

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Short Papers often fall into one or more of five main categories: technique or algorithm, system or design study, empirical study, theory, or model. The contributions of a short paper should reflect the nature of the paper. Technique or algorithm papers should state the value, or tool papers should state the value, (e.g., software release).

Think about the “writing space”

From the viewpoint of reviewers

The idea of the paper (**application** and **contribution** for VAST paper)



The writing of the paper



The figure's authentics



Minor issues

Think about the “writing space”

The idea of the paper

Application

- Broaden the breadth of your research

Think about the “writing space”

The idea of the paper

Contribution

- General visualizations or visual design (★★★★★)
- New requirements for an unknown topic (★★★★)
- Implications that benefits the vis community (★★★)
- A sound workflow to unify different parts (★★★★)

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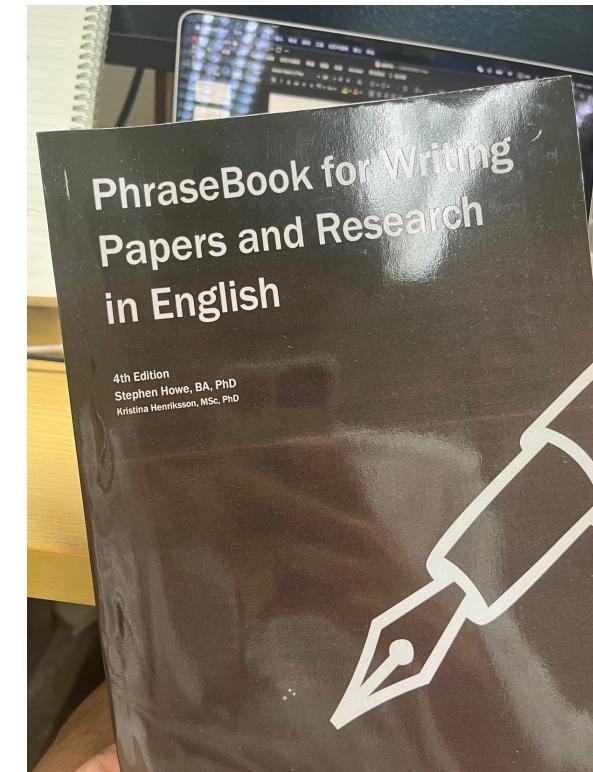
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Set the tone making your paper “can be accepted”

Ensure your paper is easy-to-follow

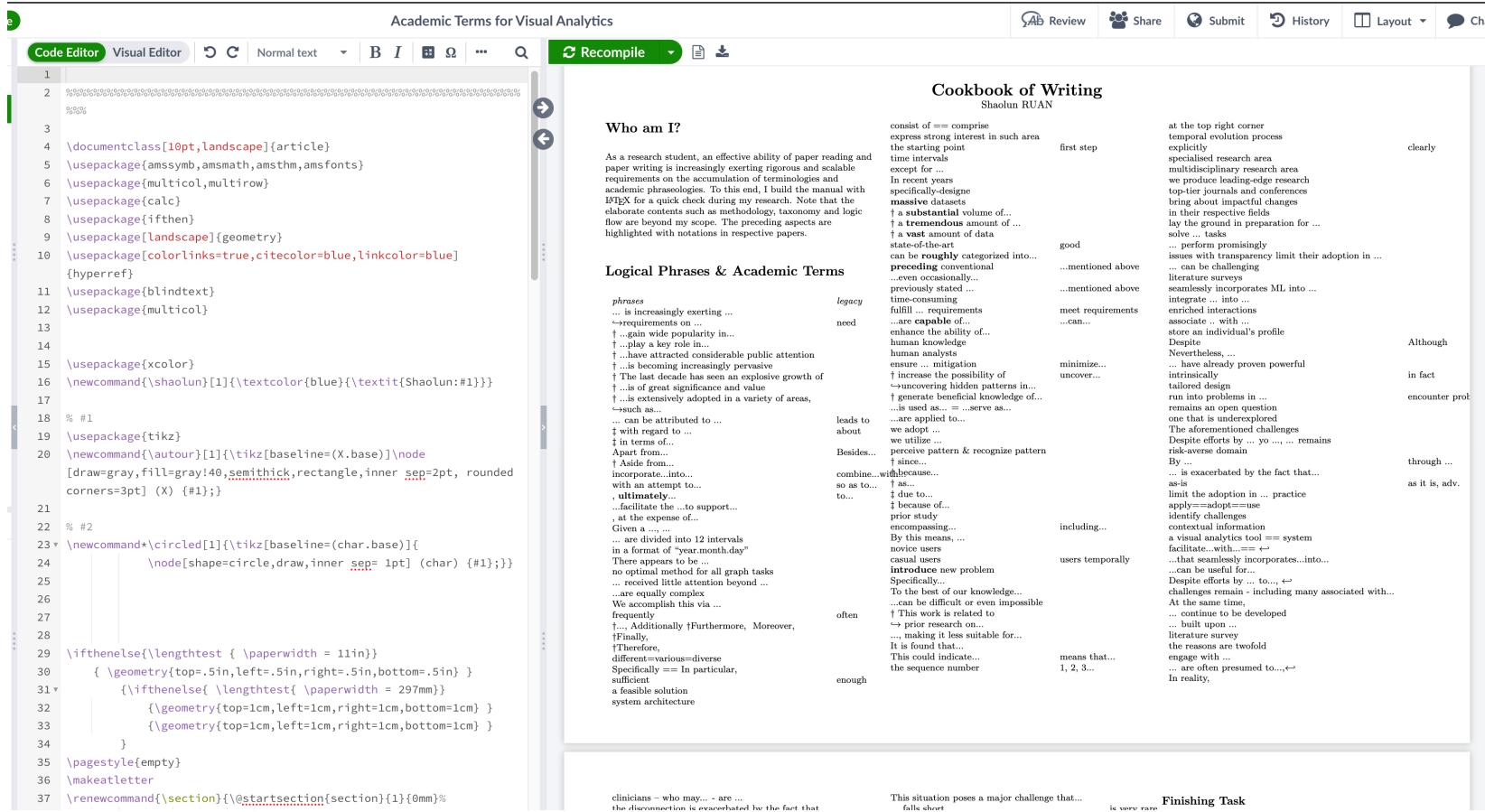
- Practice your academic writing
- Don’t reply on GPT too much!
- “The palest ink is better than the best memory”



Howe, Stephen, and Kristina Henriksson. *PhraseBook for writing papers and research in English*. The Whole World Company, 2007.

Set the tone making your paper "can be accepted"

Ensure your paper is easy-to-follow



The screenshot shows a LaTeX code editor with the title "Academic Terms for Visual Analytics". The code editor displays a LaTeX document with numerous red underlines and highlights, indicating errors or specific terms being checked. To the right of the code editor is a sidebar titled "Cookbook of Writing" by Shaolun RUAN. The sidebar contains two main sections: "Who am I?" and "Logical Phrases & Academic Terms". The "Who am I?" section lists various academic terms and their meanings, such as "as a research student", "effective ability of paper reading and paper writing", and "research interest". The "Logical Phrases & Academic Terms" section provides a comprehensive list of academic phrases categorized into columns like "phrases", "legacy", "need", "minimize...", "first step", and "good". Examples include "is increasingly exerting ...", "is becoming increasingly pervasive", "is of great significance and value", "is extensively adopted in a variety of areas", "can be attributed to ...", "is used as... = ...serve as...", "are applied to...", "leads to about", "minimize...", "uncover...", "introducing new problem", "prior study", "encompassing...", "including...", "users temporally", and "means that...". The sidebar also includes a "climbers - who may... - are..." section and a "This situation poses a major challenge that..." section at the bottom.

Set the tone making your paper "can be accepted"

Logic flow of VAST papers matters!

Why need your research? - **Motivation**



What's your solution? - **Contribution**



What's new? - **Novelty & Related work**



The need from the domain to fill the gap? - **Design requirements**



Your solution to meet the need? - **Approach**

Set the tone making your paper “can be accepted”

Logic flow of VAST papers matters!



How will you convince me your approach is sound? - **Evaluation**



You think your approach is the perfect one? - **Limitations**



Any other useful things for the follow-up researchers?
Lessons learned & Implications



Now give me some take-away - **Conclusion**

Set the tone making your paper “can be accepted”

Try to make the evaluation convincing

Case study

- Tell a “multi-faceted” story.

6 CASE STUDY

In this section, we conducted two case studies on both small-scale and large-scale quantum circuits to demonstrate the effectiveness of VACSEN. The users involved in the case studies are two quantum computing experts (U1 and U6) who also attended the user interviews in Section 7. IBM Quantum platform was used to compile and execute the quantum circuits on March 5, 2022⁵.

6.1 Case Study I - Two-qubit Circuit

U1 employed VACSEN to explore the noise of different quantum computers and select an appropriate compiled circuit for the two-qubit circuit introduced by Ash-Saki *et al.* [6]. This circuit is often used for demonstrating the different probabilities of correct results.

Striking a trade-off between quantum computer noise and queuing time. Both quantum computer noise assessment and queuing number awareness are crucial for quantum computer selection, which

6.2 Case Study II - Shor’s Algorithm

U6 used VACSEN to assess the quantum noise when trying to execute a large-scale quantum circuit, *i.e.*, *Shor’s algorithm*. Shor’s algorithm [49] is a famous and widely-used quantum algorithm for integer factorization. Meanwhile, it is usually used for the evaluation of noise optimization algorithms [14, 43]. The experiment was conducted on the IBM Quantum platform on March 5, 2022.

Balancing different noises of a quantum computer. Since the Shor’s algorithm requires seven qubits, the potential quantum computers are those with no less than seven qubits, *i.e.*, *ibm_lagos*, *ibm_perth* and *ibmq_jakarta*. U6 changed the *time range* and *interval* to 30 and 7 respectively in the control panel, to explore their status in the past month.

6.1 Case Study I - Forward Exploration

We worked with E12, who is a Ph.D. student with 3.5 years of experience in quantum neural networks, to explore the model’s prediction process. As suggested by E12, we reproduced the standard 2-dimensional datasets introduced by Zhou et al. [86] in advance. We then implemented the 3-qubit encoding and ansatz layer following the tutorial by Paddle Quantum [53]. He was asked to conduct the analysis task of forward exploration.

6.2 Case Study II - Backward Exploration

We worked with E2, who has 8 years of working experience in quantum computing, to investigate the 4-qubit variational circuits with the dataset generated by the *make_circles* function from the *scikit-learn* library. The architecture of the circuit remains the same as in the previous case. He was asked to use *VIOLET* to conduct the backward exploration for diagnosing quantum neural networks.

Identify the incorrectly-classified data points. E2 started by observing the augmented heatmap to identify the target data point. E2 first glanced at the line charts (Figure 6C) and easily found that the accuracy started to increase in Epoch 1 and converged around Epoch 50. So he selected Epochs 1, 25, and 50 to analyze further. As shown in Figure 6A1, the variational parameters were just initialized and the features learned by the model were randomly distributed, as indicated by the background augmented heatmap. After 25 iterations of training, the uncertainty of the model is high, where the confidence of predictions for Class A and B are relatively close (Figure 6A2). “I think the prediction will be totally random because the model seems to be uncertain for any input attributes.” Then, in Epoch 50, the background is divided into three layers, while the middle layers in blue

Set the tone making your paper “can be accepted”

Try to make the evaluation convincing



Case study

- **Do not involve “Strawman”**
- **Is it the same as the “usage scenario”?**
- **Split it into several “sub-stories”**

Set the tone making your paper "can be accepted"

Try to make the evaluation convincing

A. Case Study I - Grover's Algorithm

Grover's algorithm [60] is a quantum computing algorithm for searching an unsorted database, which is shown to be more efficient than classical algorithms. It works by repeatedly applying a process called amplitude amplification, which increases the probability of selecting the correct item(s) and decreases the probability of other items. We worked with E12, whose research interest includes applying Grover's Algorithm to speed up the unstructured searching problems. To find more insights behind the quantum circuit used in his research, E12 leveraged *QuantumEyes* to interactively explore Grover's Algorithm. Following the example [62], we implemented a 2-qubit Grover's Algorithm for the study.

Identifying the functionality block from the visualization. E12 began by examining the Probability Summary View and quickly noticed that the probability of State $|00\rangle$ was the largest at the beginning of the circuit. However, this dominance gradually diminished and was replaced by

Uncovering the facts of the initialization and oracle.

After the identification, E12 started to perform an in-depth analysis of each functionality block. By brushing the steps of initialization and the oracle from the stacked area chart, the State Evolution View was displayed as shown in Fig. 5B₁. To delve further into the quantum gate's effect from a high-level perspective (R2), E12 clicked the "h" symbols of the Hadamard gate and displayed the visual explanations of the Hadamard gates (Fig. 5C₁). Taking a close look at the

Exploring the hidden insights of the amplification.

E12 proceeded to analyze the functionality block of amplification, which is employed to amplify the probability of the flipped target state. By brushing the corresponding steps in the stacked area chart, E12 got a quick intuition of the operations of the CNOT gate (Fig. 5C₃ and C₄) and the NOT gate (Fig. 5C₅). To determine the reason for the sudden increase in the probability of State $|11\rangle$ (R2), E12 took noticed that the Hadamard g (*i.e.*.. $|0\rangle$ and $|1\rangle$) and genera

Understanding the architecture of QFT algorithm.

The expert E3 started by brushing the whole quantum circuit from the probability overview because he thought the QFT algorithm is an entity that cannot be split into different functionality blocks. Indicated by the first two X gates with probabilities of 1.0, E3 commented, "*These two X gates are for the state preparation because the lengths of the line segments remain the same during Block 1.*" Meanwhile, he speculated the number to be mapped is 5 due to the decimal of State $|101\rangle$. After identifying the number to be mapped, E3 started to investigate the quantum circuit architecture of the QFT algorithm (R2). By exploring the State Evolution View along

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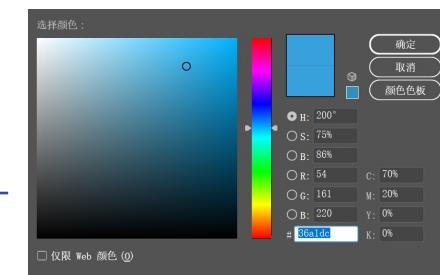
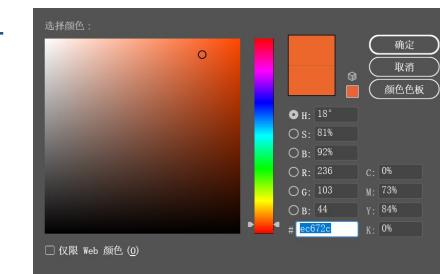
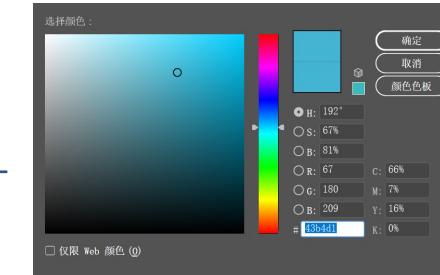
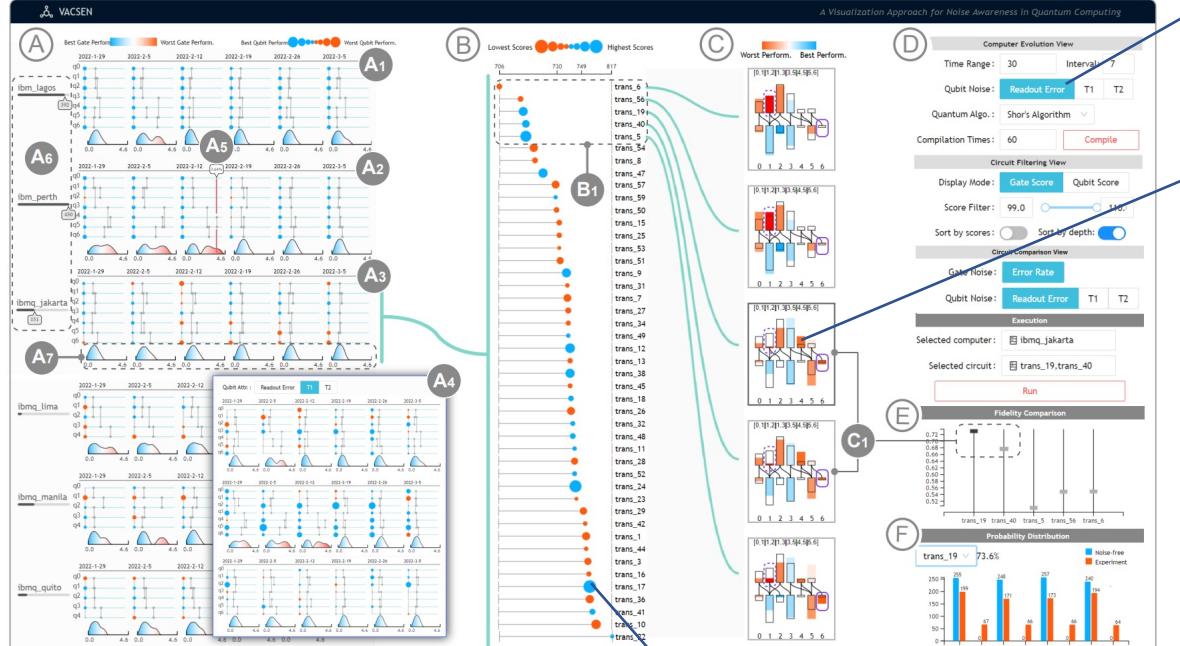
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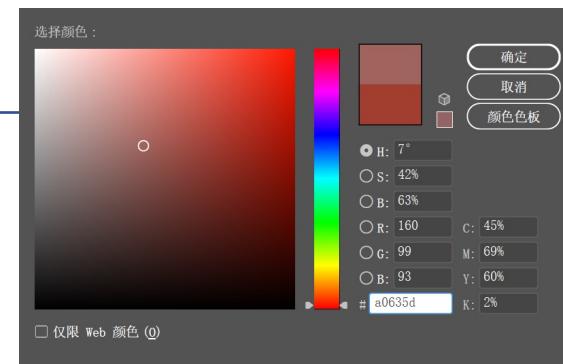
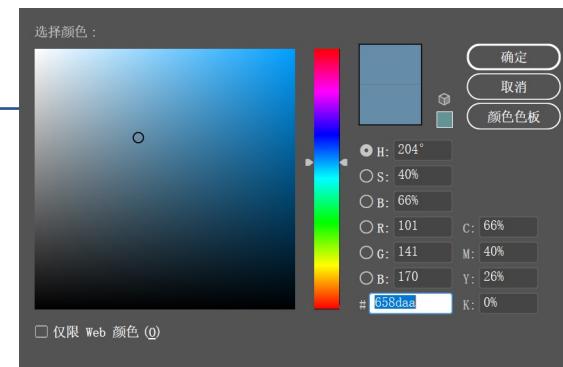
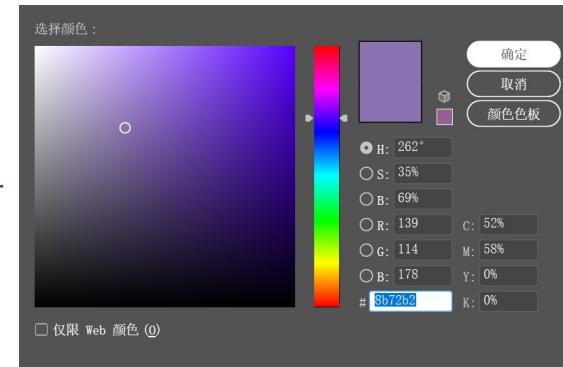
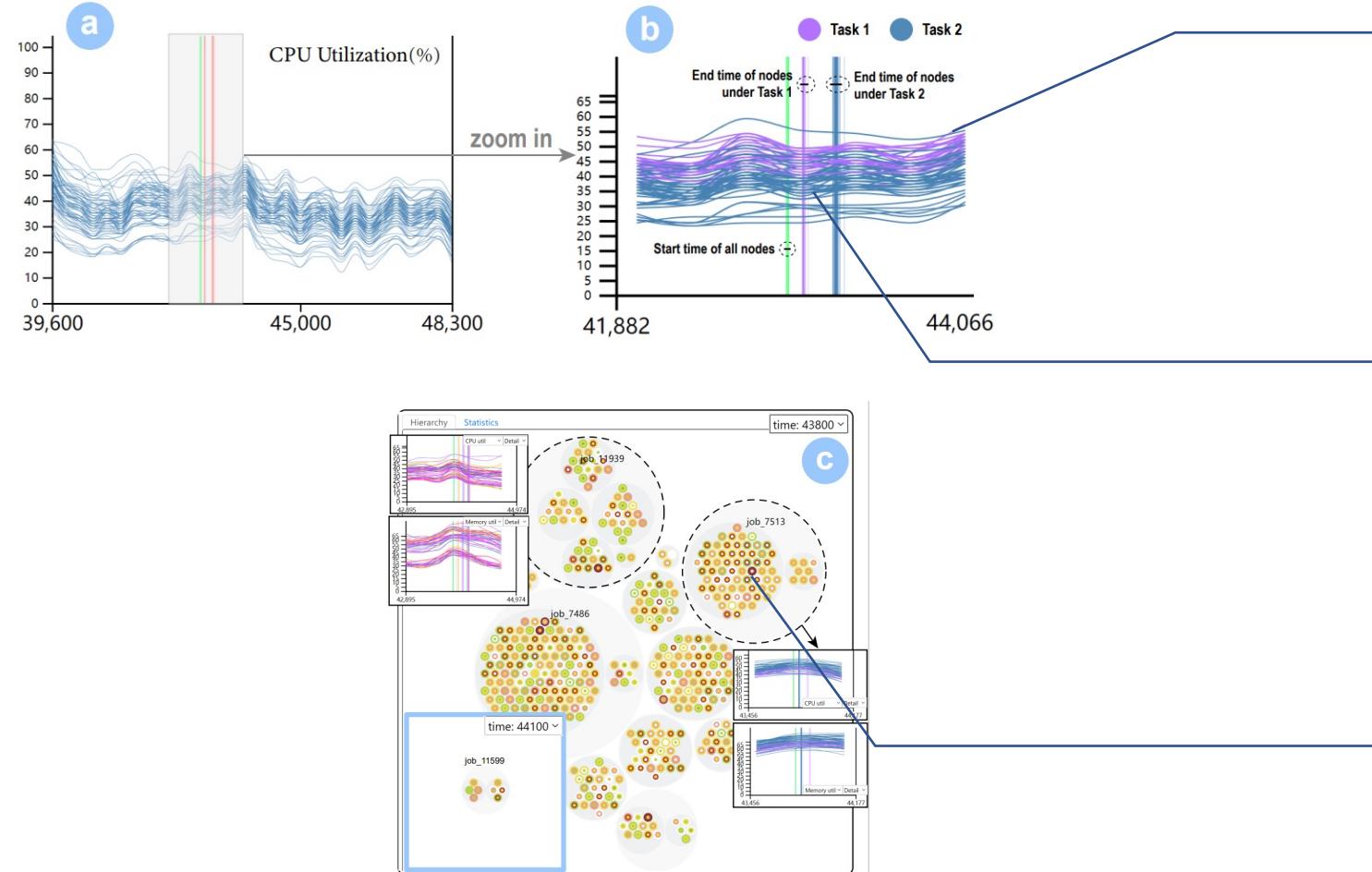
What does a VIS-tier figure look like?

Color harmony



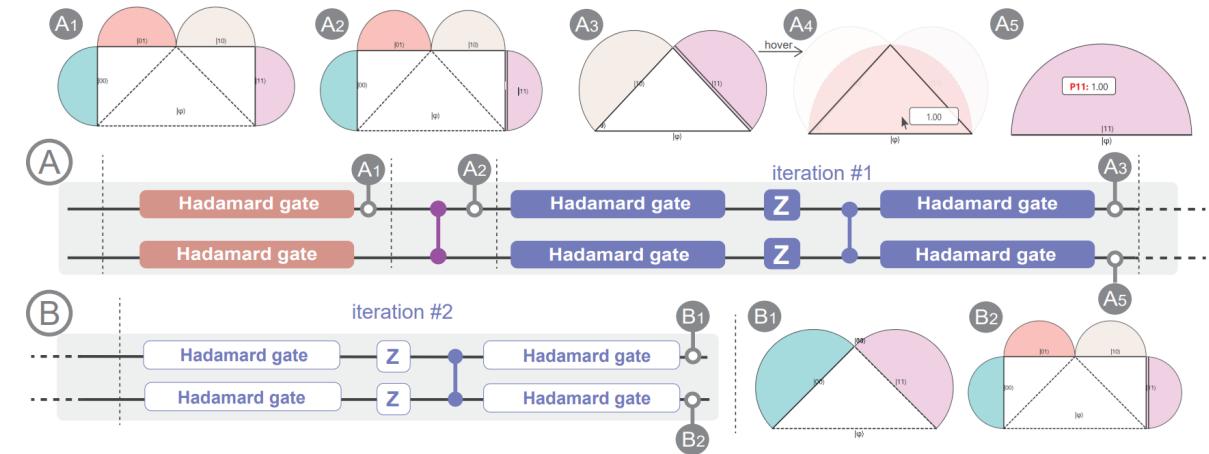
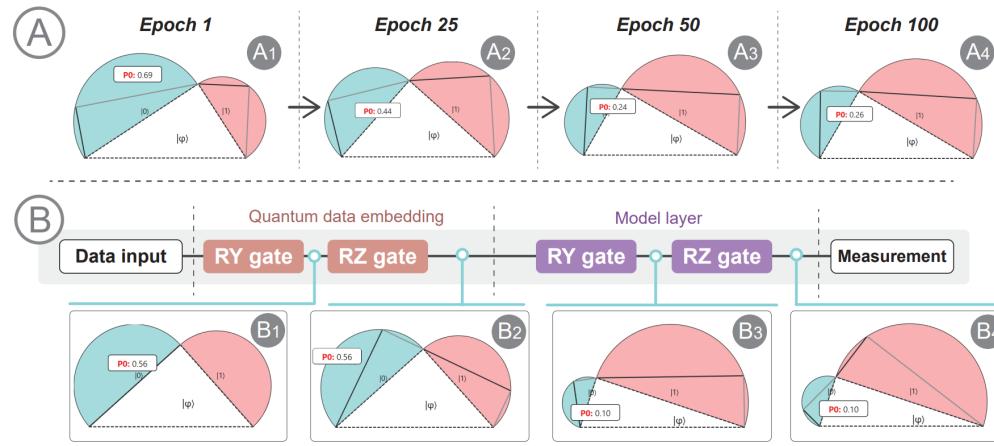
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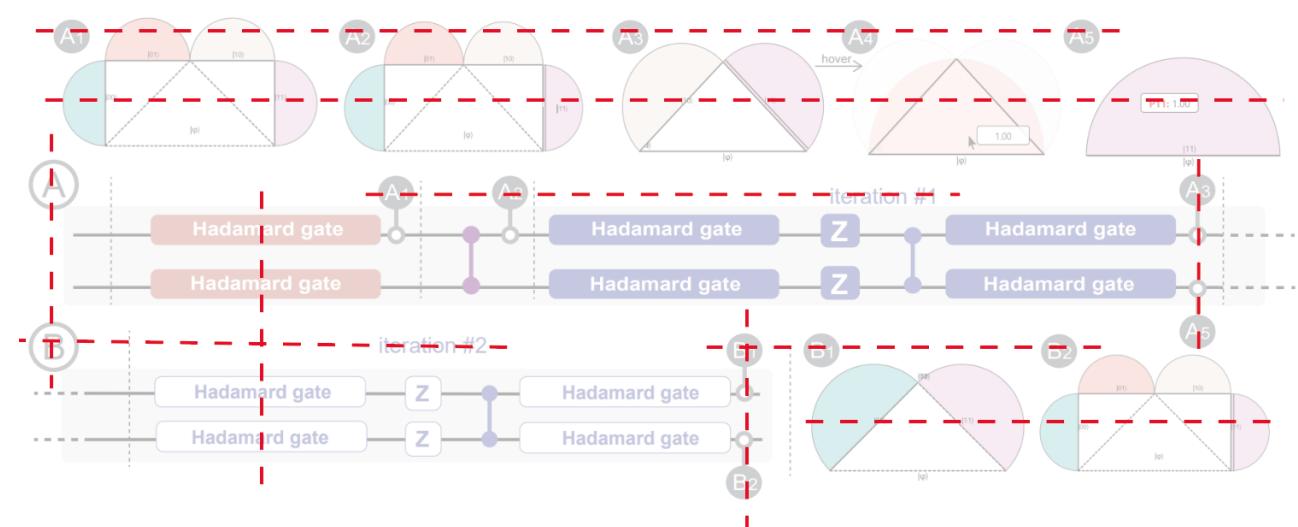
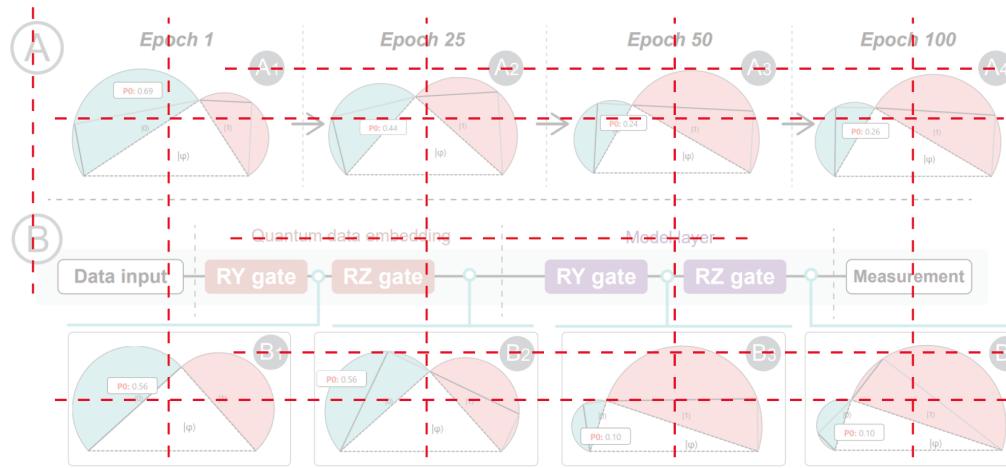
What does a VIS-tier figure look like?

“Hidden Reference Line” – the secret of looking neat



What does a VIS-tier figure look like?

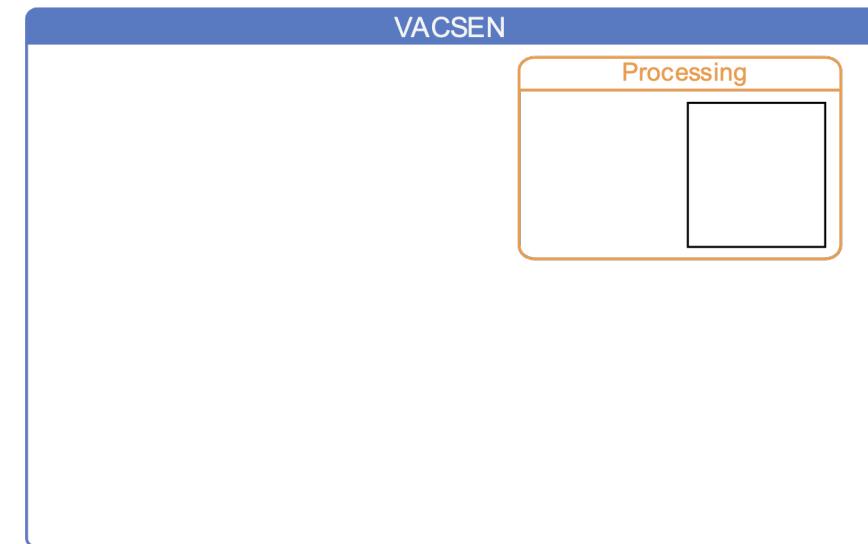
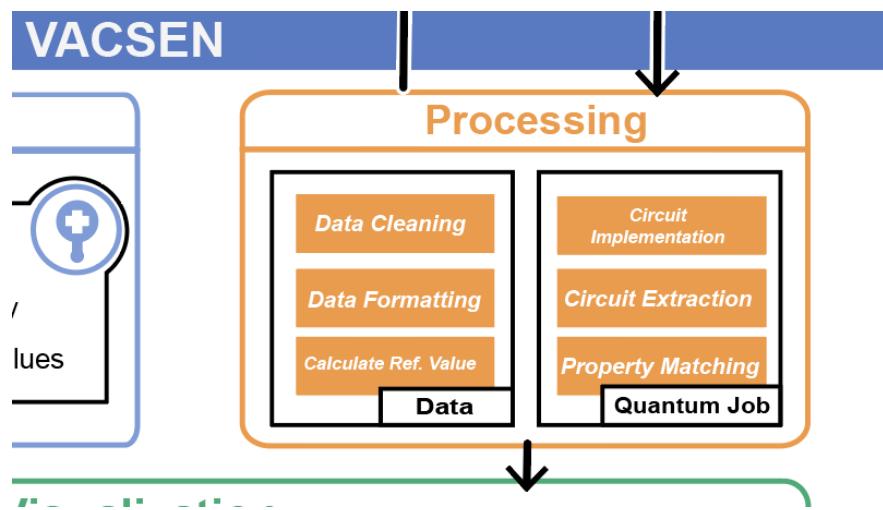
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What does a VIS-tier figure look like?

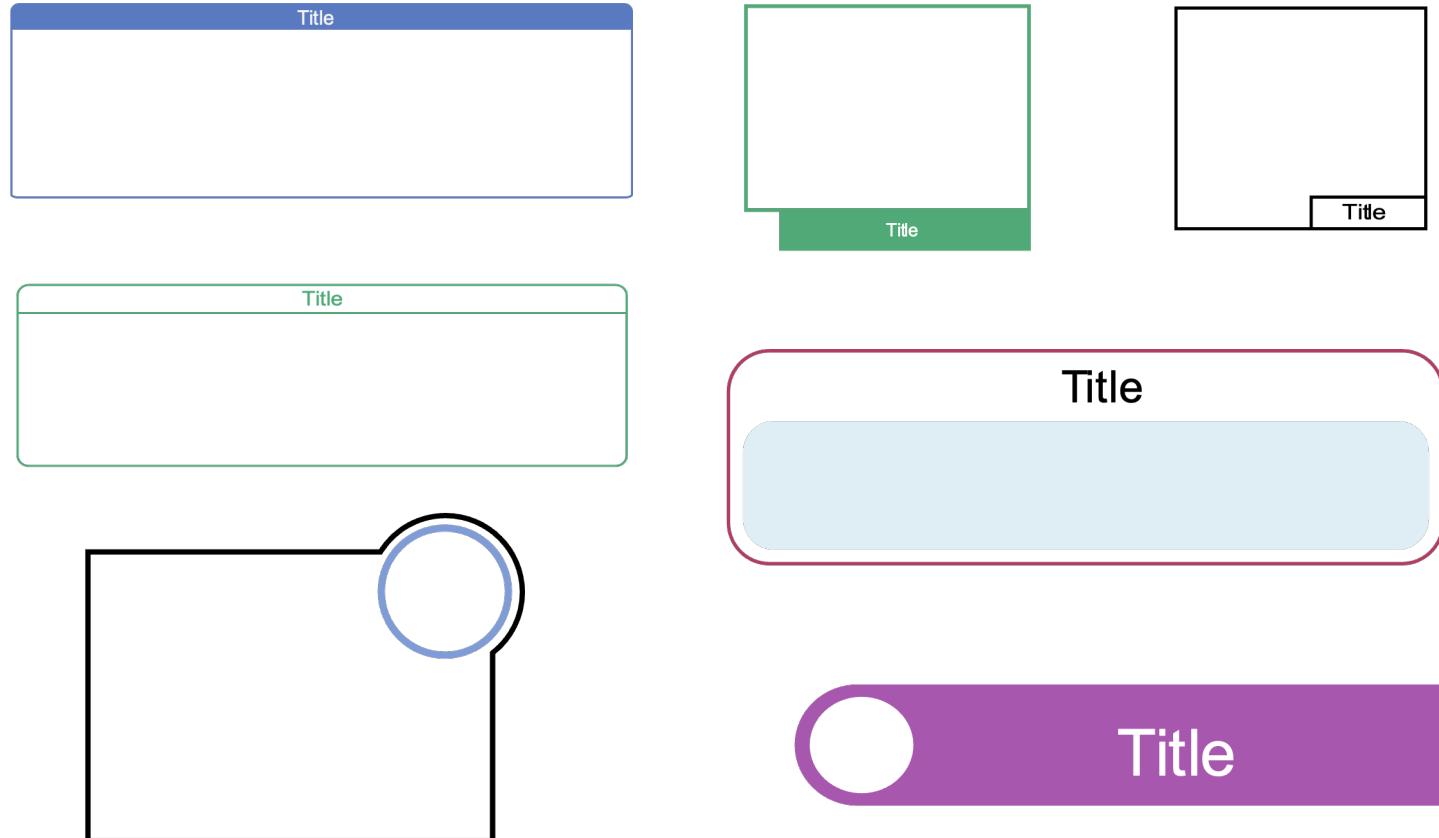
Determine border type based on the hierarchy

- Determine border type based on the **hierarchy**
 - Outer: **solid border**
 - Middle: **hollow border**
 - Inner: **simple shape**



What does a VIS-tier figure look like?

Annotations



What does a VIS-tier figure look like?

Annotations



by Ruan S.



by Wu A.



by Zeng H.

Learning documents

Source

- 《提升设计审美从多看开始》
 - https://www.bilibili.com/video/BV1im4y1Z7WN/?share_source=copy_web&vd_source=7cbca323e3701c23778ec202b2bce3b8



- 《AI教程AI2019教程(illustrator2019版 零基础入门50集)从入门到入土》
 - https://www.bilibili.com/video/BV1ox411f7tA/?share_source=copy_web&vd_source=7cbca323e3701c23778ec202b2bce3b8

Take away for figure making

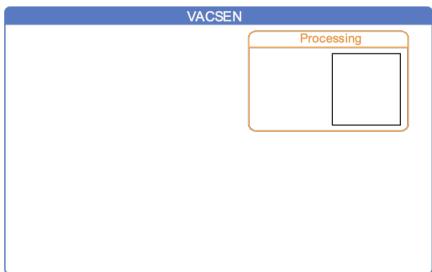
- COLOR

- Same “position” in chromatogram
- At the top left of the chromatogram, no “bottom right”
- Color number as few as possible

- LAYOUT

- “reference line” in your heart!

- SHAPE



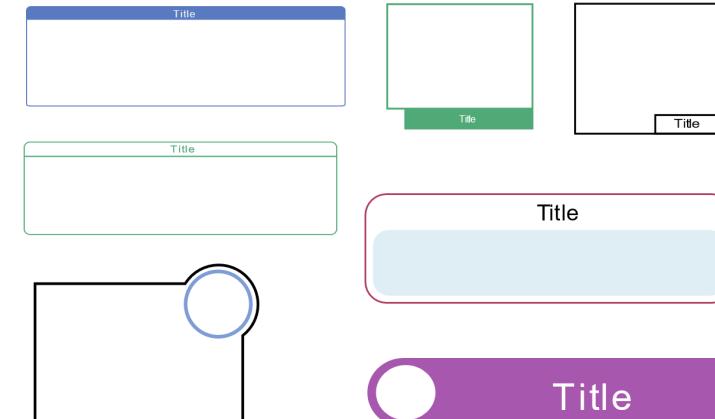
- ICON

- Chinese: <https://www.iconfont.cn/>
- English: <https://www.flaticon.com>



- ANNOTATION

- As simple as possible
- Border - FYI



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Blog Attend Contribute Program Events & Community Organization & History

29

Do everything before the April 1st

A few tips

- Finish your draft 2 weeks ahead the deadline
- Video and appendix make your research more solid to reviewers
- Open-source your tool and demo
- Treat your paper like an “art piece” 💎
- Your draft needs proofreading!
- Don’t miss a single deadline

Thank you for your attention!



Call for collaboration

I am looking for chance working with enthusiastic students!



It's you!

