Why should I stay in Academia?
Bridging Generations of Researchers in Visualization

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ABSTRACT

The question "*(Why) should I stay in academia?*" emerges often in the minds of researchers and in discussions in our community. In general, junior researchers might be more affected, but this is a choice that all levels of academic seniority face. Our panel targets an open discussion on the active choice of "staying or leaving" and its reasons, on the positives and negatives of both possible paths (academia vs. industry), and on how we, as a community, can foster a healthier environment to support and equip our members—whether they decide to stay in academia, or not. Our choice of panelists (*Silvia Miksch, Johanna Beyer, Chuck Hansen, Jan Reininghaus, Bei Wang, and Jack van Wijk*) pays attention to the inclusion of researchers from different academic ages and with different paths, to reflect different career and life challenges. We have ensured gender balance among our panelists, as female researchers often face different (and additional) challenges, and we have included a panelist from industry, to represent both sides of the coin. We anticipate that our panel will engage a large group of researchers at different career stages in a lively discussion to shape our community.

1 MOTIVATION

Pursuing a career in academia or industry is a significant decision in every scientist's life, which, as shown in Figure 1, may occur at various career stages. Since this decision may impact one's life in many aspects, it should be based on well-considered arguments and thorough discussions. From the perspective of a research community, we certainly want to keep most researchers in academia. Providing a healthy scientific home, guidance, and mentoring are preconditions to attract young researchers to join and stay in academia. This entails an open and honest discussion of this topic and a continuous self-evaluation of our scientific community. With this panel, we are bringing up a controversial—but often recurring and timeless—topic. The panel is anticipated to shed light onto the following **questions**:

 (i) Does our community suffer from a loss of human resources, and if yes, why is it the case? Does our community face specific challenges, as compared to other domains?

 (ii) What are reasons for favoring academia or industry, and what are advantages/disadvantages thereof? Are there specific things about visualization research that promote or discourage academic career paths?

 (iii) How can academia ensure that it remains attractive for young researchers? Why is academia so "uninteresting" that some of its members are leaving? What does the commercial field offer that we cannot?

 (iv) How can we equip every member adequately for either of the two paths, and support them in making informed choices?

 (v) Are there any specifics for our community that help it remain a healthy academic entity? How can we efficiently sustain current members and attract new generations of researchers?

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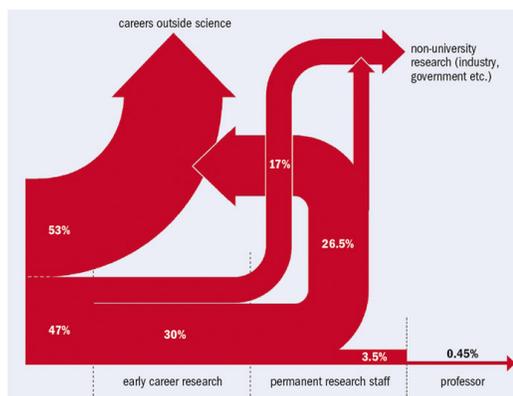[†]e-mail: ingrid.hotz@liu.se

Figure 1: Infographic showing the stages at which science PhD holders leave academia. Figure from *PhysicsWorld*.

2 OBJECTIVES

Our goal is neither to demonize the choice of abandoning academia, nor to vilify academia itself. On the contrary: it is time for our community to face its potential flaws, but also to show the motivation and the passion behind every person choosing to stay in academia. On the other side of the coin, we should also take a deeper and fair look at the positives and negatives of pursuing an industrial career. We do not often have the opportunity to discuss openly the reasons that might generate the dilemma of continuing an academic life or not, and to draw a clear (and as objective as possible, given that most of us know only the academic side) picture of both ends of this choice. At the same time, the visualization community is a highly interdisciplinary field. Therefore, an academic path in visualization may face different challenges than other fields of Computer Science, or the broader academia. As our community keeps expanding, we should ensure its healthy growth into an environment that supports its members and fosters their needs, preparing them adequately for their future career. The main **objectives** of this panel discussion are:

• To *look deeper into both aspects of the dilemma*. We all know the flaws of academia, and we all discuss them—more or less—openly. However, we do not often talk about our own experiences (positive or negative), about our reasons for staying in academia or moving to industry, and about the advantages or disadvantages of these choices. Most of us do not know much about working in industry, to begin with; so, for example, how can we advise correctly our students or motivate them, in favor of academia or industry?

• To *discuss openly what it means pursuing an academic vs an industrial career*, what are the "seeds and needs" of both paths, what are potential challenges in both, what it takes to make it work in each one of the two environments, and whether a compromise between the two can be reached. For example, academia cannot compete with the industrial salaries, but many pleasures of academic life might compensate for it.

• To *proactively search for solutions against the most common "deal-breakers"* that demotivate students and (early- or later-

stage) researchers from considering academia as a life and career choice. Several topics are raised with regard to this (e.g., balancing work and personal life, moving from one place to another, coping with stress, getting a permanent position, increasing your impact, etc.). At the end of this panel, all participants should be able to think of answers on "What can I do, to help my community overcome its difficulties and grow?"

- To *generate discussions on appropriate strategies of support* for all community members (junior and senior)—whether this touches upon personal challenges, or upon research challenges. This relates to aiding ourselves (and younger colleagues or our students) in identifying an optimal career path, in developing towards this path and in endowing for either of the two ways—academia, or industry. For instance, required skills for academia and industry do not always overlap.

- To *create stronger links within the community*—especially, between the different generations of researchers. Younger researchers face more often the question "Should I stay or should I go?". However, this is a topic that affects established researchers, as well (personally, or with the form of a younger co-worker or student that decides to leave academia). Providing a space to learn from each other's experiences and to know that this is not an exclusive frustration that has to be dealt privately can only change our community for the better.

- To *bring forward specific challenges and advantages* that academic paths in visualization face, as opposed to other "traditional" fields of Computer Science and the broader academia. For example, the interdisciplinary nature of our domain might be both an advantage and a disadvantage (*"Jack of all trades, master of none"*) for pursuing an academic career.

3   TARGET AUDIENCE AND ANTICIPATED IMPACT

We anticipate that our panel will bring together a large group of researchers at different career stages, to engage and interact with our diverse group of lively and experienced panelists. We expect that our audience will also include groups that are currently not represented in the panel, such as other commercial research units and other countries, to give also their perspective in the discussion. To engage the audience and involve them as much as possible into the discussion, we plan on creating an *anonymous platform*, where people can freely ask questions and provide suggestions for discussion, or even immediate action—before, and during the panel. *Follow-up actions* after the panel will also be sought. The anonymous character of the platform was chosen to empower everyone, who wishes to speak up and to discuss appropriately their career and life path. The following groups of researchers are expected to participate in the panel, and they are anticipated to benefit from and contribute to the discussion in the following ways:

- *PhD students:* Recommendations from the panelists on the most significant aspects of working in academia and in industry, based on their own experience. Suggestions for the community on how we could make academia more attractive and inclusive for (under)graduate students.

- *Post-Docs and early-stage researchers:* This is the career stage with the largest drop-out. Suggestions from the panelists on what to expect from now on, tips on how to deal with the aforementioned "deal-breakers", better support from the community and connections to other researchers with similar experiences. Tips for the community on how to support Post-Docs (and PhD students) in continuing an academic career.

- *Later-stage researchers, group leaders, professors:* Suggestions from the panelists on how to effectively guide and support students and younger researchers, making a better and more respectful use of human resources. Insights for the community on how they dealt with such situations in the past and on how they support their research groups.

- *Visualization community:* Concrete ideas on how to develop a more nurturing environment and on how to create a healthier and larger academic entity. Proactive development of strategies for not losing its (younger) members, for supporting them adequately and equipping them to make career choices.

4   PANELISTS STATEMENTS AND BIOGRAPHIES

Our choice of panelists pays attention to the inclusion of researchers from different academic ages, from different backgrounds and with different paths, ensuring gender balance, to reflect different career and life challenges. Although most of our panelists are working in academia, we sought to include at least one participant from industry, to present the other side of the coin. Our panelists are:

- *Silvia Miksch:* University Professor and Head of Research Division "Visual Analytics" (Centre for Visual Analytics Science and Technology (CVAST)) at TU Wien, Austria.
- *Johanna Beyer:* Research Associate at the Visual Computing Group of the School of Engineering and Applied Sciences at Harvard University, USA.
- *Charles (Chuck) Hansen:* Distinguished Professor of Computing at the School of Computing and founding member of the SCI Institute, University of Utah, USA.
- *Jan Reininghaus:* Software Developer and Manager of the Visualization Group at Siemens Industry Software, Austria.
- *Bei Wang:* Assistant Professor at the School of Computing and faculty member of the SCI Institute, University of Utah, USA.
- *Jack van Wijk:* Full Professor at the Department of Mathematics and Computer Science at Eindhoven University of Technology (TU/e), Netherlands.

4.1   Silvia Miksch: *Steering your scientific career*

Statement: Staying or leaving academia is a very tricky and multi-dimensional question and we are all aware of the benefits and limitations of staying in academia (long, precarious and fragile employments, uncertainty, pressure, competition, salary—to name a few). When I started my scientific career, I had a lot of doubts and worries, limited contracts, etc. My main strategic considerations and thinking were always to (1) realistically assess and reflect my strengths and weaknesses, (2) have a positive attitude, (3) be passionate about science and gaining insights, (4) be ready for actions and change, (5) be ambitious, and (6) have a lot of humor and fun. *Conducting science is like hiking or climbing*: there are valleys and hills—many more than you can see at first glance. You need a lot of food and water; you need to have luck with the weather; and it is more enjoyable and productive with friends and persons you trust. I have never regretted pursuing a scientific career. There are many aspects and areas that you cannot influence or rule, like promotion, or career opportunities. However, you should never miss to steer your scientific life and design a scientific and private environment to be constructive, productive, and have a lot of fun.

Biography: Silvia Miksch is a University Professor and head of research division "Visual Analytics" (Centre for Visual Analytics Science and Technology (CVAST)), which is part of Vienna University of Technology (TU Wien), Faculty of Informatics, Institute of Visual Computing and Human-Centered Technology. I have served on various program committees of international scientific conferences (paper co-chair of the IEEE VAST 2010, 2011, 2020, EuroVis 2012, etc.), belong(ed) to the editorial board of IEEE TVCG, CGF, etc., and I act in various strategic and guiding committees, such as the VAST steering committee and the VIS Executive Committee (VEC). My main research interests are Visual Analytics/Visualization (in particular Focus+Context and Interaction methods), and Time. My cross-cutting application fields are healthcare, digital humanities/arts, financial fraud detection, etc. For more information: https://www.cvast.tuwien.ac.at/team/silvia-miksch

4.2 Johanna Beyer: *Making sure it is a fair choice*

Statement: There are many reasons for choosing to work in academia or industry. General considerations include the amount of freedom in choosing your next projects, work/life balance, money, location, the opportunity to teach, etc. All of these considerations are valid and important aspects to carefully examine before choosing a career in either academia or industry. However, as the visualization community, we should make sure that young researchers choose one career path over the other for the right reasons. Unfortunately, decisions to go into industry can often be driven by factors that are not so much a preference of the young researcher, but a necessity.

We need to address several issues in academia and our community, to enable young researchers to make a fair decision between academia and industry. These *issues involve inclusion and diversity, work/life balance, and money.* First, how can we make sure that our research community is inclusive and welcoming to people with diverse backgrounds (e.g., gender, sexuality, disability, age, socioeconomic status, ethnicity, race, culture)? It is difficult to attract new talent if they do not see themselves represented in our community. Second, how can we lead by example to demonstrate that it is possible to work in academia and still have a healthy work/life balance? How do we show young researchers that they can and should have a fulfilled life outside of the lab and work environment? Third, how can we ensure that we provide young researchers (especially in internships) with enough funding opportunities to meet their basic needs? All of these issues currently drive young researchers out of academia and into industry, especially underrepresented groups, leading to a "brain drain" in the research community. If we want to give young researchers a fair choice between academia and industry it is up to us to change some things.

Biography: Johanna Beyer is a research associate and lecturer in the Visual Computing Group of the School of Engineering and Applied Sciences at Harvard University. Before joining Harvard, she was a postdoctoral fellow at the Geometric Modeling and Scientific Visualization Center at King Abdullah University of Science and Technology. She received a PhD in computer science from the Vienna University of Technology in 2010, supervised by Meister Edi Gröller. Her research interests include scalable methods for visual abstractions, large-scale volume visualization, immersive analytics, and the combination of abstract information visualization with scientific visualization for novel domain-specific applications.

4.3 Chuck Hansen: *Mastering your own destiny*

Statement: The choice of industry and an academic career is one with many trade-offs. *Do you want to pursue your own ideas or work on a product/area that may, or may not, fit your interests?* Either choice will likely involve writing proposals, especially a research lab setting. Either choice will involve writing research papers, if you are involved in research. Academics certainly make less money than industrial folk. However, time management is more under your control, in an academic setting. Involvement and mentoring of students can be greatly rewarding. This is key for the academic environment, but can also be part of the industrial research, if there are student interns. One of the challenges for US-based academic careers is the necessity to bring in funding: both for at least 25% of your salary and for student support. In the end, it may simply be a lifestyle choice, but it is typically easier to move from academia to industry than from industry to academia.

Biography: Charles (Chuck) Hansen is an IEEE Fellow and a Distinguished Professor of Computing in the School of Computing and a founding member of the Scientific Computing and Imaging Institute at the University of Utah. He received bachelor degree from Memphis State University in 1981 and a PhD in computer science from the University of Utah in 1987. Since 1997, he has been on the faculty in Computer Science at the University of Utah.

He was a visiting professor at the University Joseph Fourier in 2011-2012, a SimTech Fellow at the University of Stuttgart in 2012, and a visiting scientist at INRIA-Rhone in the GRAVIR group in 2004-2005. From 1989 to 1997, he was a Technical Staff Member in the Advanced Computing Laboratory (ACL) located at Los Alamos National Laboratory, where he formed and directed the visualization efforts in the ACL. He was a Bourse de Chateaubriand PostDoc Fellow at INRIA, Rocquencourt France, in 1987 and 1988.

Chuck Hansen has published over 170 peer reviewed journal and conference papers and has been a co-author on three papers recognized with "Best Paper Awards" at the IEEE Visualization Conference (1998, 2001, 2002). He was co-author on the Best Paper at IEEE Pacific Visualization 2010. He was awarded the IEEE Technical Committee on Visualization an Graphics "Technical Achievement Award" in 2005 in recognition of seminal work on tools for understanding large-scale scientific data sets. In 2017, he was awarded the IEEE Technical Committee on Visualization and Graphics "Career Award" in recognition for his contributions to large scale data visualization, including advances in parallel and volume rendering, novel interaction techniques, and techniques for exploiting hardware; for his leadership in the community as an educator, program chair, and editor; and for providing vision for the development and support of the field. Chuck Hansen served on the VGTC Board from 1995-2002. He was on the IEEE Visualization Conference Steering Committee from 2001-2004 and initiated term limits during that time. He has co-Chaired IEEE Visualization 2000, was Program co-Chair for Visualization '99 and served as a papers co- Chair for IEEE SciVis (then called IEEE Visualization) in 2007-2008. He co-Chaired IEEE LDAV in 2014. He was twice an Associate Editor in Chief (AEIC) of IEEE Transactions on Visualization and Computer Graphics (TVCG) and was on the editorial board of Elsevier Computers and Graphics Journals. He currently is chair of the IEEE-CS Transactions Operating Committee. His research has made contributions to the fields of scientific visualization, computer graphics, parallel computation and computer vision.

4.4 Jan Reininghaus: *Making a conscious decision to leave academia*

Statement: Why should you stay in Academia? Because you made a conscious decision to do so, being fully aware of the perks and perils of this special career path. There can be regional differences in the actual risks and rewards, but many countries share some properties. For example, in the German system the decision whether you end up with a permanent position or whether you (are forced to) eventually leave academia is delayed for a very long time. During this multi-year probation period you additionally might have to change location several times. Also, competition for the few permanent positions can be quite fierce and can lead to a race to the bottom when it comes to work-life balance which can lead to stress and can have severe personal consequences. Finally, the city, region, or even country, that you end up living in might not be to your liking. All of these potential issues can have a huge impact on your personal happiness, relationships, friendships, as well as family life. *The actual significance of the individual issues is of course different for everyone and is something that you should assess for yourself.* Does the reward outweigh risk? What are the alternatives? Should you abandon the academic career path at some point, will you have regrets or would you make the same decision again because you enjoyed the ride?

If academia wants to convince more students to go for such a career I think the duration of the probation period must be significantly decreased. It should be possible to assess whether someone has the skills required for a permanent position much sooner, especially considering that people enter such a career path with a PhD already completed. Stringing talented young people along for multiple years is neither ethical nor efficient from a societal point of view. Re-

forming the existing system will be difficult however since the main group of people that is negatively affected by the existing system does not have a lot of power for effecting change.

Biography: Jan Reininghaus studied Mathematics at Humboldt University of Berlin, specializing in Numerical Analysis, and received his Masters degree in 2007. He then joined the Emmy Noether group led by Ingrid Hotz at Zuse Institute Berlin where he worked on leveraging Discrete Morse theory for visual data analysis. In 2012, he received his PhD and subsequently joined the research group of Herbert Edelsbrunner at IST Austria in Vienna. As a postdoc, Jan focused on developing fast and scalable algorithms for topological data analysis and developed a method that allows persistent homology to be combined with machine learning, decreasing the gap between these two rapidly evolving fields.

In 2015, Jan left academia and joined the visualizing group of CD-adapco (later acquired by Siemens) in Vienna as a software developer for STAR-CCM+, an industrial multi-physics simulation software package. Since 2018, Jan has been managing the visualization group, working with his group on topics such as global illumination or virtual reality in an industrial setting.

4.5 Bei Wang: *Finding out what you're good at and becoming great at it*

Statement: I use topology in visualization. So please allow me to describe my career path (thus far) using topological terms. My career traces out a trajectory on the surface of a Morse function. There are local maxima—when I solve (or have the illusion of solving) a particular problem, my students get published, my grants are funded, etc.—for a brief moment, I would feel like being on the top of the world (however local it is). There are saddles—where I am not sure where I should go—either uphill or downhill. I once asked my Ph.D. advisor what I should do if I felt like a chicken running around with the head cut off. His answer was: "most times when you ask that question, you have already made up your mind." I think I know what he meant now. There are of course local minima—when I feel I am stuck and there are no way out. Some of these minima have high persistence, that means, it requires a huge amount of perturbation to the function to become unstuck.

One of those local minima with high persistence happened in 2015, I was working as a research scientist at my university. It was one week from the VIS deadline. I was working on four papers. And most importantly, I was pregnant with my 2nd son and my due date was the VIS deadline. Then I was told that there was going to be a "funding gap" for my position. I submitted my papers, and my son was born 6 hours after the VIS deadline. I remember, at some point, while holding my baby in one hand, I was searching Craigslist with the other hand for hourly tutoring jobs. This was the moment I seriously considered quitting academia.

Fast forward the darkest moments, how did I get unstuck? First, I had amazing family, friends, and mentors from VIS. I was told that since I am very good at what I do, why should I give it up? So instead of quitting academia, I applied for tenure-track jobs. Second, I was and I am still grateful for NSF, which gave me my first million dollar grant so that I could kickstart my own research group. Third, to quote Godfrey H. Hardy: "I do what I do because it is the one and only thing that I can do at all well." It is somewhat important to realize that *"following your passion" may not be the same thing as "identifying what you're good at"*. In my case, these two things happen to align.

To stay (somewhat happily) in academia, in my opinion, takes quite a bit of efforts: (a) be independent, intellectually and financially, so you could maximize academic freedom; (b) have amazing family, friends, collaborators, and mentors—it is so much more fun to get to a local maximum, a saddle, and even a local minimum, with someone by your side; (c) according to Scott Galloway, find out what you're good at and become great at it.

Biography: Bei Wang is currently assistant professor at the School of Computing, a faculty member in the Scientific Computing and Imaging (SCI) Institute, and an adjunct assistant professor in the Department of Mathematics, University of Utah. She received her Ph.D. in Computer Science from Duke University. She is interested in analysis and visualization of large and complex data. Her research interests include topological data analysis, data visualization, computational topology, computational geometry, machine learning, and data mining. She has worked on projects related to computational biology, bioinformatics, and robotics. Some of her current research activities draw inspirations from topology, geometry, and machine learning, in studying vector fields, tensor fields, high-dimensional point clouds, networks, and multivariate ensembles.

4.6 Jack van Wijk: *Doing what you like and what makes you happy*

Statement: Choosing between a career in academia or industry can be tough. The pros and cons are clear, there are differences in, for instance, freedom, salary, certainty, and obviously content-wise, as education is a central component of being a professor. Much harder is to weigh and balance all these aspects, which requires a deep and honest reflection on your personal desires, strengths and weaknesses. What makes you proud? What do you enjoy most? What excites you? What were your greatest accomplishments so far? How do you see the balance between your career and personal life? What are your main strengths? Furthermore, it is important to collect information and to experiment. Do internships at industry, to sense the atmosphere and judge how you feel being immersed. Talk with seniors that are further in their career, get inspired by their stories about their successes, but also ask them what their daily agenda's look like—work is often less glamorous than it looks from the outside. And in the end, your choice is personal: *aim for positions that make you happy and enable you to learn and grow further*. And if it turns out you made the wrong choice, do not hesitate to reconsider, and enjoy that you learned from the experience.

Biography: Jack (Jarke J.) van Wijk is full professor in visualization at the Department of Mathematics and Computer Science of Eindhoven University of Technology (TU/e). He received a MSc degree in industrial design engineering in 1982 and a PhD degree in computer science in 1986, both from Delft University of Technology, both with honors. After a short period in the software industry, he has worked for ten years at the Netherlands Energy Research Foundation ECN. He joined Eindhoven University of Technology in 1998, where he became a full professor of visualization in 2001. His main research interests are information visualization, visual analytics, and mathematical visualization. He is cofounder and VP Scientific Affairs of MagnaView BV (now UIPath-ProcessGold), another start-up from his group is SynerScope BV, and in 2018 AnalyzeData BV has started. He is scientific director of the Professional Doctorate in Engeneering (PDEng) program on Data Science, and scientific director of the Data Science Center Eindhoven (DSC/e).

He has (co-)authored more than 150 papers in visualization and computer graphics. He has been paper cochair for IEEE Visualization (2003, 2004), IEEE InfoVis (2006, 2007), IEEE VAST 2009, IEEE PacificVis 2010 and EG/IEEE EuroVis (2011, 2016, 2017). He received the IEEE Visualization Technical Achievement Award in 2007; the Eurographics 2013 Outstanding Technical Contributions Award; best paper awards at IEEE InfoVis 2003, IEEE Visualization 2005, IEEE PacificVis 2013, IEEE InfoVis 2014; IEEE VAST 2015, the 2009 Henry Johns Award of The Cartographic Journal, and the IEEE InfoVis 2019 20 Years Test of Time Award. In 2019 he was inducted into the IEEE Visualization Academy.