Related to the bureaucracy, keep in mind that you might need a visa to work in Europe and, depending on your citizenship, this could take some nontrivial effort. Depending on the type of visa you will be issued and whether your institution belongs to the Schengen-area or not, this might allow you to easily travel to other European countries without asking for other visas. If this is the case, then you will be able to travel freely within the Schengen-area—which encompasses most EU States, except for Bulgaria, Croatia, Cyprus, Ireland, and Romania—in order to attend conferences or visit your collaborators at other universities. Europe is large and diverse, and it can provide an excellent opportunity for you to meet and get to know different cultures.

Another aspect that might be scary is the language. Unless you are considering only positions in the UK or Ireland, you might end up living in a country where English is not the first spoken language. Depending on the country where the university is located and on the size of its international community, this might be a marginal problem or a very serious issue to consider. In any case, it is important to remember that most postdoctoral positions in Europe do not involve mandatory teaching, and you are usually not required to learn the local language to do your job. It can however happen that in some universities some research seminars or advanced graduate classes you might be interested in attending are offered in the local language. But it can be an excellent opportunity to improve your French, or German, or Spanish, or Italian, or…

In conclusion: do not hesitate to broaden your horizons. Maybe the job you are looking for is on the other side of the Atlantic.


Federico Binda


Chiara Damiolini

Credits

Photo of Federico Binda is courtesy of the Archives of the Mathematisches Forschungsinstitut Oberwolfach.
Photo of Chiara Damiolini is courtesy of C. Damiolini.

Giving a Job Talk

Brian Lehmann

Congratulations on being invited to interview! The last major piece of your application is the job talk. Math departments take these talks seriously: a good job talk will generate excitement about your candidacy but a bad job talk can derail your application. This is your final opportunity to make your case for the job and you should make the most of it!

The goal of this article is to describe how to prepare for your job talk. I will assume that you have been asked to present on your own research (either for a teaching or a research position).

While preparing this article I have drawn from several resources on how to give a compelling talk. There are many other good references out there—including some in previous issues of this journal—and I will provide a short list in the bibliography.

Overview of the Talk

If you have been invited to interview for a job, there is a subset of the department—perhaps the professors in your discipline or on the hiring committee—which believes that you are a strong candidate. They are already convinced! However, the entire department will have a say in the selection process. Thus:

> *The main goal of your job talk is to convince the entire department to support your application.*

Expectations for your talk

The professors attending your job talk may not have a chance to interact with you during the rest of your visit. This is your main opportunity to convince them of your qualifications for the job. Here are some questions these professors will have in mind while they listen to your talk:

1. Does this candidate do first-rate research (if applying for a research position)? If you are applying for research jobs, there is no substitute for outstanding research.

2. Is this candidate a good teacher? It is difficult to assess the quality of a candidate's teaching from their applications and letters. However, many departments do not require candidates to give a teaching presentation. Thus the job talk is often used as a proxy. This is not wholly unreasonable—a candidate who can explain one topic clearly can probably explain other topics clearly.

3. Would I be able to talk math with this candidate? Successful mathematicians often need to communicate their ideas to nonexperts—during colloquiums, while

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writing grants, and even in casual conversations around the department. There will also be times when a professor in your department will require your expertise. The strongest candidates will demonstrate the ability to communicate effectively and flexibly to diverse audiences.

4. Would this candidate be a good colleague? Each hire is a significant decision that is not easily reversed. A new hire might stay in the department for 40 years. Thus departments would like to hire someone who is responsible and professional.

Goals of your talk

For each expectation, you should have a corresponding goal:

1. Make your talk compelling. Your talk should present your research in the most compelling way possible. Remember, this means impressing the entire department, not just the mathematicians in your field. Frame your work so that nonexperts will understand why it is important.

2. Make your talk clear. Construct a cohesive narrative that gives a sense of what you do and why it matters. Think carefully about the essential points you want to communicate and remove all the material that does not serve these goals. Watch for terminology or leaps of logic that will be familiar to mathematicians in your area but may confuse others.

3. Make your talk broad. Your talk should be designed for mathematicians who are not experts in your field. Make sure to highlight any connections your work has with other mathematical and scientific disciplines.

4. Demonstrate good talk practices. Your talk should be pleasant and respectful in every way possible. Make sure to thank the hosts. Give generous attributions (and don't forget your coauthors). Dress well. Be respectful with questions. Finish on time. Tell everyone how great your work is but do it in a humble way.

Structure of the Talk

There is not one right way to give a job talk. This is not going to stop me from suggesting one. Even if you choose not to follow the model below, my hope is that it leads you to think through how the various elements could be incorporated in your presentation.

You will often hear the advice, "Give the audience something to take home," and this is doubly important for your job talk. By the end of your talk, everyone in the audience should be able to clearly answer the following three questions: What is your research question? What did you do? Why is it interesting? The outline below is centered around answering these three questions.

Part 1: Introduction (15–20 minutes)

Your introduction should answer the question, "Why is my research area interesting?" You should start by providing background or context that will pique the curiosity of your listeners. There are many approaches that could work well: How have the major conjectures in your field developed and evolved over time? Which examples/pictures will grab the attention of the audience and motivate further inquiries? What new perspective leads to/follows from your work? How is your work connected to other fields? The key is to construct a narrative—conceptual, historical, or example-based—which naturally culminates with your work.

The introduction should be understandable to *everyone* in the audience. In terms of mathematical background, you can assume material that could be covered in an undergraduate course or, perhaps, a first-year graduate course—homology, abstract algebra, basic real and complex analysis, etc. (The appropriate level will depend on the audience, the institution, and the job you are interviewing for, but this is a good guideline.) If you need an additional definition that you think most people will know, it is appropriate to briefly remind everyone of its definition (e.g., "Recall that an algebraic variety is…"). Clarity is more important than precision—if technical details will be distracting, work in a simpler setting that captures the essence of your construction.

It can be difficult to strike the right balance. On the one hand, your talk should be accessible and grounded in the familiar. Mathematicians are happy to have a brief review of material they have seen before. On the other hand, you should never bore your audience—this portion of your talk should be exciting and new. Don't assume that your listeners are familiar with your area, but also do not underestimate the collective expertise represented by the department. One way to keep things fresh is to communicate a new perspective. Which innovative viewpoints have shaped your field? Which viewpoints feature prominently in your work? If you can trace these ideas from simple beginnings, your narrative will feel profound and dramatic.

Part 2: Setting the stage (15–20 minutes)

Part 2 should clarify, "What question does my work solve?" This does not mean that you rephrase your main theorem as a question. Rather, you should describe some of the definitions, earlier conjectures, partial results, and examples that have shaped your field and led to your specific line of inquiry. The audience should see how your motivating question is a natural and interesting continuation of the background material covered previously.

You should work hard not to lose anyone during the second portion of your talk. Take your time with new material! While it is appropriate to slowly increase the difficulty level, it is neither reasonable nor desirable to spend too much time on the technical subtleties of your field (unless of course these difficulties are part of your narrative). Rather, you should only present the ideas and definitions that are essential background for your work. Remember that an intuitive explanation may serve better than a technical one—for example, a definition that takes 10 minutes to state precisely will confuse those who have not seen it before and will bore those who know it already.

Well-chosen examples can go a long way toward providing this intuition.

Part 3: Presenting your results (20–30 minutes)

Part 3 should answer the question, "What results have I proved?" Usually it is best to focus on one or two of your most important theorems rather than giving an overview of your work. Whenever possible use examples to illustrate your results.

Resist the temptation to include too many details. Remember that your audience will not share your excitement about minor obstacles you had to overcome. It may be appropriate to share one or two key ideas from the proof, but you should avoid getting bogged down in a lengthy technical discussion. If you feel that you absolutely must spend some time speaking only to the experts, you may do so *but* you should alert your audience beforehand and you should keep it brief.

If possible, end the talk by giving a sense of your future research plans. If your mathematical narrative has not yet reached its conclusion, what are the next steps? Do you have a plan of attack? This is a great opportunity to generate excitement over your future research potential.

Other Advice

In this section I will expand upon some earlier comments.

Logistics

You should find out all the details about your talk beforehand. This includes: the location and time of the talk, (exactly) how long you have to give the talk, how much time is set aside for questions at the end, and what formats are available (i.e., chalk vs. whiteboard vs. computer presentation).

Know your audience

It is a good idea to familiarize yourself with the department that invited you. Will your audience include both applied and pure mathematicians? Will most of the department attend the talk? Will there be any students at the talk? Will you be speaking to 10 people or to 50? Also, are there special qualifications for the job that should be addressed by your talk? If the department is looking for a number theorist your talk should involve some number theory.

Practice

Regardless of your typical routine, you should practice the job talk beforehand. Practice on your own with a timer—no matter how meticulous your preparation, there will be some aspects of a talk (e.g., "this part is slow and boring") that can only be discovered while at the board. Make sure you do not rush through, but give the talk as if you were actually in front of an audience. Record the time required to finish each portion of your talk and think carefully about whether you are happy with this allotment.

After practicing on your own, you should ask a mentor in your department to listen to your talk and give feedback. (Make sure this is someone you trust to give honest and constructive advice.) Then you should incorporate this feedback and practice again.

Timing the end

At this point in your career you know that you should *absolutely never ever* go over time. (Surely you are not one of those presenters who routinely go late. Surely.)

The interviewing department will tell you a number which is purportedly the amount of time you have for your talk. You should take it with a grain of salt. It is quite common to start a couple minutes late. Also, you should anticipate receiving some questions which will slow down your pace—job talks elicit more questions than seminars. This means:

1. Your presentation should be tight—focus on a single narrative and do not deviate from it.
2. You cannot leave your own results to the last minute. Make sure your key results are communicated before the talk is scheduled to end!
3. Resist the temptation to speed up the end of your talk. No one benefits from a five minute discussion condensed into two minutes. Just end early!

Alternatively, you could consider scheduling a "time flexible" activity at the end. This could be presenting additional results, or computing an example, or discussing an interesting feature of the proof—something that adds to the presentation but can safely be skipped if need be.

Broader connections

Here are several ways you can highlight connections with other areas of mathematics. First, you can take a historical perspective. Most fields of modern mathematics share similar roots. Which problems first sparked the development of your field? How has it diverged from neighboring fields?

Second, you can look for loose analogues of your results in other fields. Certain foundational objects and examples are shared between many different fields. How does your research area interact with other ways of looking at these objects? How could your motivating question be interpreted in a different framework?

Third, if your work has interesting implications for other disciplines you should be sure to mention them. However, be careful not to oversell—mathematicians abhor duplicity.

Boardwork

The best piece of advice on talks that I ever received was to prepare the board layout beforehand. When you give a talk using a chalkboard or whiteboard what you write is more important than what you say. If an audience member spaces out for five minutes, they should be able to recover the thread of the narrative simply by what is written on the board. By sketching out each board beforehand, you can ensure that the layout is clear, that important ideas get emphasized, and that extraneous details are omitted.

If you give a slide talk, similar principles apply. Think carefully about how to best support the narrative using what you write on your slides. Only essential information

should be included, but nothing essential should be left out. Also, make sure that you do not overload a slide with too much information. Remember that the audience can only view one slide at a time; you need to think carefully about the flow of information to ensure that our archetypical spaced-out audience member can follow. Finally, try your hardest to make your slides look nice.

Questions from the audience

Receiving a question from the audience can be very stressful, particularly if someone is challenging a statement you made. It is easy to get defensive or nervous. Make sure to relax and try to put yourself and others at ease. If you need to take half a minute to gather your thoughts, then do it! It might help if you prepare the answers for some likely questions in advance, but you should also expect some surprises.

The correct mindset while receiving questions is respect—respect for the question and respect for the questioner. The first step is to listen carefully to the question. It can be useful to repeat the question to ensure that you are understanding it correctly—this will also give you a chance to formulate an answer. If you don't understand it, then ask a clarifying question. Make sure that your answer addresses the question. (Occasionally it might be appropriate to go off on a tangent, but make sure you answer the question first!) If you don't know the answer, it is usually best to be honest about it. On the other hand, you will sometimes receive nonsensical questions, in which case you should do your best to respectfully explain the confusion.

It is not appropriate to get into a lengthy discussion with the person asking the question. If your talk is getting sidetracked, offer to continue the discussion after your talk is finished. And of course, if someone does catch you out in a mistake, be gracious and thankful. It shows they were paying attention!

Final Thoughts

Job talks are stressful experiences. Nevertheless, I would encourage you to view your talk as an opportunity rather than a pitfall. Remember that the audience is on your side—everyone likes to hear a good talk and to be informed about exciting research. And with practice and careful preparation you can put yourself in an excellent position to succeed. Good luck!

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Mentoring for Tenure-Track Interviews

Anthony Várilly-Alvarado

Job interviews for academic positions really matter, and interviewing poorly is easy. Ask anyone who has served in a department's Appointments Committee. For better or worse, our profession is full of informal interactions and inadequately planned talks. Most of us learn by example, and every-day life in a mathematics department can leave a student or postdoc woefully unprepared for tackling the intensity and formality of a job interview. As a mentor to a graduate student or postdoc, it is part of your job to make sure a mentee is ready to tow the fine line between behaving professionally in a formal setting, and letting their personality shine through.

Questions

Most interviews have a similar structure: individual or small group meetings with faculty members, a discussion with the department chair, a meeting with a dean, a talk, and usually one or two meals with department members (typically lunch and dinner). As a mentor, it is important to prepare your mentees to have questions for all occasions, and to encourage them to *ask the same questions to different people in the same department*. It is surprising how inconsistent answers can be! These differences are useful: the interview cuts both ways, and it is important for your student or postdoc to understand if *they'd* like to join a particular department. Differences in the answers to questions can simply reflect the personal style of the people answering questions, or they can be symptomatic of a certain amount of dysfunction. Your mentee will have to decide how much dysfunction they can live with.

Some questions I have either asked or have suggested to a mentee are: are assistant professors expected to advise bachelor/masters theses? How about doctoral students? Do you have regular seminars? How do you fund them? Are there opportunities to teach specialized courses in your field with some regularity? What is your current teaching load for research-active faculty? For administrators: How do you see the Math Department developing/growing over the next five years? Do you fund student/postdoc/faculty

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