A place of one's own in mathematics

No place for a woman between two consecutive integers!

Cambridge, Thursday April 27th 2017

Building up a career in mathematics is still very tricky for women. Inspired by Virginia Woolf who claimed that having a room of one's own is essential for women writers, we shall analyse some of the obstacles that can prevent a woman from finding a place of her own in the world of mathematics.

I would first like to thank **Carola-Bibiane Schönlieb** most warmly for all the work she did to present here in Cambridge, an extended version of the exhibition with photographs by Henry Kenyon. This was possible thanks to the help of Orsola Rath-Spivack and the support of Holly Krieger, Anne-Christine Davis, Marianne Freiberger, Rachel Thomas, Rachel Furner, Christie Marr, Yvonne Nobis, Natalia Berloff, Nilanajana Datta and Julia Gog. Thanks to all on behalf of the present Berlin-Potsdam team: the photographer **Noel Matoff,** my colleague **Sara Azzali** and myself.

Statistical data show that there are still very few women nowadays, who find a place in the academic world of mathematics.

The organisation *Femmes et Mathématiques* has done a great job in collecting statistical data concerning the situation in France. They report that in pure mathematics, whereas there were 25% women among the assistant professors in 1996, there were only 18% in 2016. Compared with 9% women among the full professors in 1996, only 6% of the professors in 2016 were women. On the basis of this decline in the past 20 years, **Isabelle Chalendar** anticipates that there will be no woman professor left in France in 2077.

Mathematics being a very competitive discipline, there is no reserved place and it is difficult for anyone whether man or woman, to build up a career in academia as a mathematician; it is even more so for a woman. Rather than finding a place where there are so few spare ones, women can find themselves building their own *niche, a place of their own.*

Quoting Virginia Woolf:

"But, you may say, we asked you to speak about women and fiction-what has that got to do with a room of one's own? I will try to explain. When you asked me to speak about women and fiction I sat down on the banks of a river and began to wonder what the words meant."

These are the very first sentences of the famous essay by Virginia Woolf « *A room of one's own* » (1929) written from notes prepared for talks she had been asked to give at Newnham College and Girton College (in 1928), that at the time were the only two (they were also the first ones) Cambridge « Colleges » for women. Allow me to substitute two words:

But, you may say, we asked you to speak about women and mathematics-what has that got to do with a place of one's own? I will try to explain. When you asked me to speak about women and mathematics I sat down on the banks of a river and began to wonder what the words meant."

I have sometimes been asked   to talk about women and mathematics. I am a woman and a working mathematician, but not a sociologist and do not feel competent to talk about women and mathematics. Also, being part of the community of women mathematicians, I lack the necessary distance to analyse the situation of women in mathematics in an objective manner. The very question is ambivalent; are we asking about women regarding mathematics or mathematics regarding women ?

Turning things around, as a professional mathematician and a woman, today, I offer to share with you my personal outlook on these issues. It will be a subjective outlook, the same one that led to this exhibition with Noel Matoff's photo portraits that put the subject in the forefront.

During the winter 2014, I received an invitation from a young colleague at the University of Kostanz to give a talk on women and mathematics. Had I been near a river, I might have sat down on its bank to try to figure out a reply to the invitation. I was about to decline the invitation, since I had (and still have) no specific competence in social sciences and hence did not feel I could seriously analyse statistical data (there were and still are very few gender specific data) concerning the situation of women in mathematics in academia throughout. I felt I could not legitimately give a talk on such issues.   But then, I started thinking of the female mathematicians around the world I had met on conferences or other scientific trips abroad, of their striking personalities with a mixture of determination and shyness. I remembered how impressed I had been by their enthusiasm for mathematics in spite of all the obstacles they had had to overcome to find a place in academia. It then occurred to me that I could talk about those women, their joys and their difficulties, most of which I could relate to. This is how a small booklet was born with interviews of ten women mathematicians around the world.

  Cheryl Praeger, who is one of the mathematicians interviewed in this booklet, will be giving a talk   tomorrow, Friday April 28th , for the opening of the exhibition,on the other side of the world, at the University of Melbourne.

These interviews, probably subconsciously inspired by filmed interviews of four women mathematicians, a video made at the 7th general EWM meeting held in Madrid in 1995, served as a basis for the talk in Konstanz and can be seen as forefathers/mothers of this more ambitious touring exhibition that was opened this week in Cambridge. Let me also mention the filmed interviews made at the 14th   general EWM meeting that took place in 2009 in Novi Sad (two years after it had been held in Cambridge),   in Serbia, a meeting organised by **Dusanka Perisic** who is one of the protagonists of this exhibition, that were also probably still present in my mind at the time.

In Konstanz, the men in the audience showed a genuine interest in the talk I had built up on the ten interviews; talking of women mathematicians, their lives, their difficulties and their joys, I was also talking about them.   Since then, various men told me they could identify with some of the issues raised in the interviews you can read in the exhibition catalogue and where women talk in a subjective manner about their trajectories as mathematicians.

 At tea time colleagues tend to gather in the mathematics department's common room to chat about mathematics, academic issues, but rarely does one talk about oneself, does one mention personal problems. Subjectivity is left behind; you hang it on the coat rack as you arrive at the office, and put it back on when you leave. Mathematics and feelings don't mix very well. But can the only woman in the common room really put aside her subjectivity when she is first perceived as a female subject and maybe only later as a mathematician?

When asked « *Could you describe your favourite personal achievement in mathematics*? », Barbara Nelli, an Italian mathematician working at the University of l'Aquila, answered*: A personal achievement I vividly recall is something that happened while I was in France for my PhD. I had come to work with Harrold Rosenberg, and had told him so when I first met him. During one of the classes I took with him, he asked me to solve the following problem: "Show that the solution of a positive Gauss curvature equation on a punctured disc extends continuously to the disc", which I indeed solved. This, I think, was what triggered his decision to supervise my PhD thesis.*
Long after my PhD he told me I had been the first female PhD student he had had.

In working out a proof, **Barbara Nelli** proved she was capable of becoming a mathematician. This opened a door into the world of mathematics to the young post-doc she was at the time. Everyone is expected to prove that she/he is capable in order be allowed into the world of mathematics but the gap is probably wider for a woman to step over than it is for a man…. in part due to self-censorship.

Talking about the Abilitazione, Barbara Nelli reports on her own experience: *«I passed the "Idoneità" (a competitive exam which enables you to apply for such a position) in 2003 and was actually promoted in 2005. I am still not a full professor although I was selected for "Abilitazione" (habilitation) in 2013.*
This is a selective procedure, unrelated to a position. Actually, due to the lack of full professor positions in Italy, particularly in geometry, among the fifty odd people who were selected for the "Abilitazione" at the same time as I was, only five were appointed professors and two of them are women. The statistics show that fewer women than expected apply to get the "Abilitazione", in spite of their merits, which speaks to the fact that women censure themselves, a widespread phenomenon among women due to cultural reasons. »

The women mathematicians presented here share with us their feelings, their regrets, their joys, talking about their mathematics, their children, the war and also about flowers.   **Oksana Yakimova**, from Russia and who until recently was working in Jena, is another mathematician portrayed in the exhibition. This is how she comments on her experience in collaborating with other women mathematicians.   *«Even though I enjoy collaborating with women, I find it more difficult than with men, since we start talking about other things; starting from mathematics, we can end up talking about flowers! Men are much more focused, no flowers with them! »*

Could we describe the fact of letting oneself be distracted, letting one's thoughts drift away from mathematics to flowers and other things, as a typical female feature? Is distraction really an obstacle to research? Mathematicians know how fruitful a digression can be when doing research « *Pour inventer, il faut penser à côté* » (*"In order to invent, you need to think aside[i]"*) according to Paul Souriau, philosopher of the beginning of the 20th century, quoted by Jacques Hadamard in his « Essai sur la psychologie de l'invention dans le domaine mathématique. » (« *Essay on the psychology of invention in mathematics »*). Virginia Woolf's digressions brought her to writing a text that has had a strong impact on generations of readers including men or women.

While thinking about the contents of her talk, Virginia Woolf takes a walk on the university grounds and tells us about… the flowers, the golden colour bushes, the weeping willows she sees… not about women and fiction she is going to talk about:

To the right and left bushes of some sort, golden and crimson, glowed with the colour, even it seemed burnt with the heat of fire. On the further bank, the willows wept in perpetual lamentation, their hair about their shoulders.

Lost in her thoughts, Virginia Woolf finds herself on the lawn, face to face with a Beadle summing her to get back on the path:

His face expressed horror and indignation. Instinct rather than reason came to my help, he was a Beadle, I was a woman. This was the turf, there was the path. Only the Fellows and Scholars are allowed here; the gravel is the place for me.

Not only had her thoughts drifted away, her footsteps had followed them and she had trod on the lawn, a privilege reserved for Fellows et Scholars, probably all men. The digression in her mind hat led to two transgressions. She had just been reminded that she is a woman and hence that this was not her place?

As an aside, and since we are in Cambridge, let me recall a fact that is well-known to this audience; before women were first admitted as full members of the University of Cambridge in 1948, they were allowed to take University examinations as from 1882, but were not classed or admitted to degrees; their names appeared as interpolations on the list. If a woman was ranked among the Wranglers, she would be described as being "between the nth and (n+1)st Wrangler", for the appropriate value of n. **No place for a woman between two consecutive integers!**

For a woman to step away from a position she is expected to hold, might it be that of a good spouse or a good mother in order to dedicate her time to a creative activity might it be literary, musical, in the visual arts or in mathematics, meant in the past and can in some respect still mean transgressing barriers, some visible other less. Many obstacles can come into her way, among the visible are domestic tasks and family responsibilities, among the less visible and hence toughest ones to resist to, are other people's judgment, social pressure, bad conscience and self-censorship already mentioned.

Let us listen to Ann Finch, Duchess of Winchilsea, who lived from 1661 to 1720 and is quoted ny Virginia Woolf in her essay. Annand her sister beenfited from an advanced instruction for the time so that Ann was at ease with Greek and Roman mythology as well as with the Bible, learnt French and Italian, had some knowledge of history, poetry and drama. She wrote several love poems to her husband, the most famous of which is «*A letter to Daphnis* », but her best known works reveal her depressive states and express her concern for more justice for women :

« Alas ! a woman that attempts the pen,

Such a presumptuous creature is esteemed,

The fault can by no virtue be redeemed.

They tell us we mistake our sex and way;

Good breading fashion, dancing dressing, and play,

Are the accomplishments we should desire;

To write, or read, or think or to enquire,

Would cloud our beauty, and exhaust our time,

And interrupt the conquests of our prime

While the dull manage of a servile house

Is held by some our utmost art and use."

Let me confront these 17th century verses with the adaptation and staging by the stage director Katie Mitchells   of the text „*Schatten (Eurydike sagt)"* ("*Shadow (Eurydice says)*")   by Elfriede Jelinek,   presented last summer at the Schaubühne in Berlin.

Eurydice comes back from the realm of the dead. Orpheus, a famous pop singer, leads her through narrow corridors to a narrow and dark lift and takes her along endless underground avenues During their journey back to the realm of the living, Eurydice recalls her life as a frustrated writer in the shadow of her lover Orpheus in a society that could not offer her a proper place as an author. The nearer she gets to the end of the journey, the more she realises that she had rather her "non existence" as a shadow in the world of the dead, than the life in the body of a woman directed by another person. When she decides to turn back to the realm of the dead, the ferry man hands her out a pen. Eurydice had to give up her life in order to write.

Elfrieda Jelinek, Nobel prize winner in 2004, lives somewhat isolated on the outskirts of Vienna, in a room of her own, a recluse which probably helps her write. There was a big controversy around her nomination for the Nobel prize (reported in a text "*How to get the Nobel prize without really trying*" written in 2006 by Gitta Honegger), that led to the resignation of the Swedish Academy of one of its retired and octogenarian members.   Jelinek was clearly very happy to receive the Nobel Prize, but felt "*despair for becoming a known, a person of the public*". Known for her modesty and subtle self-irony, she wondered if she had been awarded the prize mainly for "*being a woman*", and suggested that among authors writing in German,   Peter Handke whom she praises as a "living classic", would have been a more worthy recipient.

 Also, a woman entering politics can be disturbing and even threatening for her male colleagues and competitors. She can be "put back into place":   « *Who is going to take care of the children ?*» was a question asked by her competitor Laurent Fabius to Ségolène Royal in 2006, after she had announced she would be a candidate for the presidential elections. In the first round of the 2007 elections, Royal got 60, 65% votes and Fabius only 18, 66 %.

We all know of women, specifically in mathematics,   who managed to combine professional and personal commitments. To quote only two among many more of our contemporaries; **Claire Voisin**, member of the Academy of Sciences, professor for algebraic geometry at the prestigious Collège de France and CNRS gold medallist in 2016, who is the mother of five; **Frances Kirwan**, also an algebraic geometer, professor at Oxford University, who was awarded with various prizes amongst which the senior Whitehead prize in 2013, and who since 2014 is Dame Commander of the Order of the British Empire, is also the mother of three. You

can read more about her trajectory on the exhibition panel dedicated to her and in the full interview in the catalogue.   A younger and hence more recent recipient of the Whitehead prize (2016) known to you all, is **Carola-Bibiane Schönlieb** whom I would like to congratulate at this point, both for her scientific achievements and her commitment as the present very dedicated convenor of EWM. Further back in time and in another area of science, let me mention **Irène Joliot-Curie**, a French scientist, who together with her husband **Frédéric Joliot**, received the Nobel prize in chemistry in 1935 for the discovery of artificial radioactivity; not only did she combine her intensive scientific activity with her family life, she moreover shortly (and somewhat reluctantly) went into politics on request of Léon Blum, who appointed her vice-secretary of State in the Front Populaire government of 1936. In a radio programme (a broadcast of a 1976 radio programme « Les après-midi de France Culture ») I learned that to her husband who was proudly commenting « Isn't the Wilson[ii] chamber the most beautiful experiment in the world ?» Irène replied « No, the most beautiful one is giving birth to a child ». Irène Joliot, as dedicated a scientist as she was, also had other things in mind than mere science. Having been brought up in a family of scientists probably helped her to develop an ability to combine her various roles, as a mother, a scientist and a politician.

For other women scientists, maternity was a tremendous obstacle. A few years later, in 1948 and on the other side of the Atlantic, in Brazil, Sonia Aschauer (1923-1948)   was coming back to Sao Paolo from Cambridge, where she had done a PhD thesis under the supervision of Paul Dirac. She was the only woman among the few PhD students Dirac ever had.   Soon after she had taken up her new position as assistant professor at the University of Sao Paolo, she retrieved in some remote part of Brazil. The sad news of her sudden death at the age of 25, probably in childbirth, arrived at the physics department some moths later. On her tomb,   the following poem of Mark Twain is engraved:

Warm summer sun shine kindly here,

Warm southern wind blow kindly here,

Green sod above, lie light, lie light,

Good night dear heart, good night, good night,

… and when you awake to yonder beauty

On the other shore,

We shall be together again,

Death ridded and happy

Forevermore

Conjectures have been made about who had this poem engraved, probably the father of the child who was never born. Ligia Rodrigues, professor of physics emeritus at the Brasilian Center of Research in Physics in Rio de Janeiro, who   investigated on Sonia Ashauer's case, interviewing her few remaining relatives, would be grateful for any documents in Cambridge concerning Sonia.

In the exhibition, you can read about less tragic life paths of women mathematicians, some better known than others, who all share the joy of mathematics, and many of whom could conciliate this pleasure with being a mother. All were able to cope with the vissicitudes of life,

like Dusanka Perisic who was directly affected both in her personal and professional life by the war in Serbia, where she is still working today.

To the question "*Did you come across obstacles in pursuing your career as a mathematician?*" Dusanka replies:

The biggest obstacles I met were the long period of economic and scientific sanctions imposed on my country, subsequently hyperinflation, comparable to the one which happened in Germany in the thirties, and finally the war our country went through. They had a great impact on my life and career.

I had a scholarship to spend a semester in Austria after my Master's degree, and my wish was to do a PhD in the US. I applied for a Fullbright scholarship, not realising how prestigious and difficult it was to get such a scholarship, but it turned out that I was indeed selected and therefore offered the scholarship. I was waiting for the official confirmation to leave for the US when I   received a letter (which I have kept), informing me that due to the economic and scientific sanctions in that part of former Yugoslavia (this was in 1991), my scholarship had been "suspended". So instead I did a PhD in Novi Sad which I defended in 1992.

Let us listen to Irina Kmit, originally from Lviv in Ukraine, presently on a temporary position at the Humboldt University in Berlin, talking about the sense of freedom she gest from mathematics:

[..] *solving mathematical problems gave me a unique sensation of freedom, that did not depend on what happened around me. I actually think that this was the reason why mathematics was so strong in the Soviet Union; in mathematics people were able to find the freedom they missed in real life.*

At the time of the interview in 2015, Irina from Ukraine and Oksana from Russia had respectively a Humboldt grant and a position as a "Junior professor", both enviable statuses for young mathematicians. However, to the best of my knowledge, neither of them have   yet fond a permanent position. Finding a position as a mathematician in Academia is difficult for anyone but more so for a woman. Even when having a permanent position, it is difficult for a woman to find a place in the so called mathematical community, an international network in permanent communication, whether real or virtual, might it be in conferences, on visits or through internet. This intense communication can be exhilarating and the agitation of the community or of one's circle of mathematical pairs around a specific mathematical issue, a conjecture, a counter example, can be contagious and a real pleasure to follow. For any mathematician, it is essential to belong to a mathematical network at a time when the individual disappears behind macrostructures expected to rationalise the scientific production, and beyond that, the production of knowledge.

Having timidly opened the big impressive door to mathematics, can the female mathematician actually feel comfortable in this huge network community? Can she find her place in the international « men's club » web to which she is cordially welcomed in words but not in facts? Hanging on a thread of the web, she often has to wait for her turn to come to find a place on a node of the web.

Let me close this talk quoting Virginia Woolf once again ; in her essay « A room of one's own », she imagines William Shakespeare with a fictitious "*extraordinarily gifted*" sister called Judith Shakespeare,   " *as adventurous, as imaginative*" as her brother. She tells the

reader how William learned Latin and read *"Ovid, Virgil and Horace"*, whereas Judith *"remained at home"*. Judith refused to get married and headed off for London to become an actress. « *She stood at the stage door; she wanted to act she said. Men laughed in her face."* At last an *"actor manager took pity on her; she found herself with child by that gentleman and so- who shall measure the heat and violence of the poet's heart when caught and tangled in a woman's body?- killed herself one winter's night and lies buried at some cross-roads where the omnibuses now stop outside the Elephant and Castle."*

Jacinta Torres and Claire Glanois, both post-docs at the Max Plank Institute for Mathematics in Bonn and authors of a very interesting video *"Women and time, Freedom and Mathematics"* that you can see on the web page of the exhibition, imagined a fictitious sister for Alexander Grothendieck. He himself died in December 2014, and his mathematical heritage is probably as important for the future of mathematics as Shakespeare's heritage is in the realm of literature. Alexander actually had a half sister Frode, nicknamed Maidi, born in January 1924 from Hanka Grothendieck and Alf Raddatz. After a few years spent in Berlin in total poverty, Maidi was handed over to her maternal grand-parents in Hamburg. Alexander Grothendieck, born in Berlin a few years later, in March 1928 from Hanka Grothendieck and Alexander Schapiro, mentions in his memoirs how he suffered from having to leave his sister and parents when he was put in a family in Hamburg for some 5 years, after which he was sent to Paris with the rising threat of persecution for those like him, of Jewish origin, his father being a Jew. Exile, which he experienced as a young child with his flight to Paris, is a theme that runs through his impressive (both in length and content) piece of work *"Harvesting and Sowing*" (« Récoltes et Semailles »). The title he gives to one of the paragraphs « *Of the importance of being alone* » (« *l'importance d'être seul* »)—a solitude he claims is necessary for mathematical research— resonates with Viriginia Woolf's title « *A room of one's own* ». In that paragraph, Grothendieck advocates[iii] « *transgressing* », « *trespassing* » *(« passer outre »), « being oneself and not merely following a concensus that dictates the rules»*. He recommends *«stepping out of the set boundaries –creating is a solitary act"* he writes and *«The rest follows* » *(« d'être soi-même en somme et non pas simplement l'expression des consensus qui font loi, de ne pas rester enfermé à l'intérieur du cercle impératif qu'ils nous fixent -c'est avant tout dans cet acte solitaire que se trouve « la création ». Tout le reste vient par surcroît.* ») He opposes « *homebird mathematicians* » (« *mathématiciens casaniers* ») and « *pioneering builders* » (« *bâtisseurs-pionniers* ») ; only when you leave home, can creation take place, in transgression.

Shortly after he arrived in France under the Vichy regime, Alexander was put in a camp with his mother in the South of France. Like him, his sister Maidi suffered from a harsh childhood, which she partly spent in various institutions including one for mentally retarded children, which she was not herself. However, although very gifted like her brother, unlike him she was not going to have a fulgurant trajectory. Three « stumble stones » were recently (March 22nd 2017) laid in Berlin for Alexander, his Jewish father Alexander Tanarov and his (non Jewish) mother Hanka Grothendieck, but none for Maidi, born from another father. I still have the hope that one might be laid for her some day.

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[i] This and the following parts in French are loose translations of the original texts in French.
[ii] The Jolliot-Curie couple built a Wilson chamber that multiplied by 76 the observable length of the radiating trajectories.