MARGUERITE'S THEOREM

a film by **Anna Novion**

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a film by Anna Novion

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SUPERMARKET
CHRISTIAN STRÖHLE

christian@super-market.ch +41 79
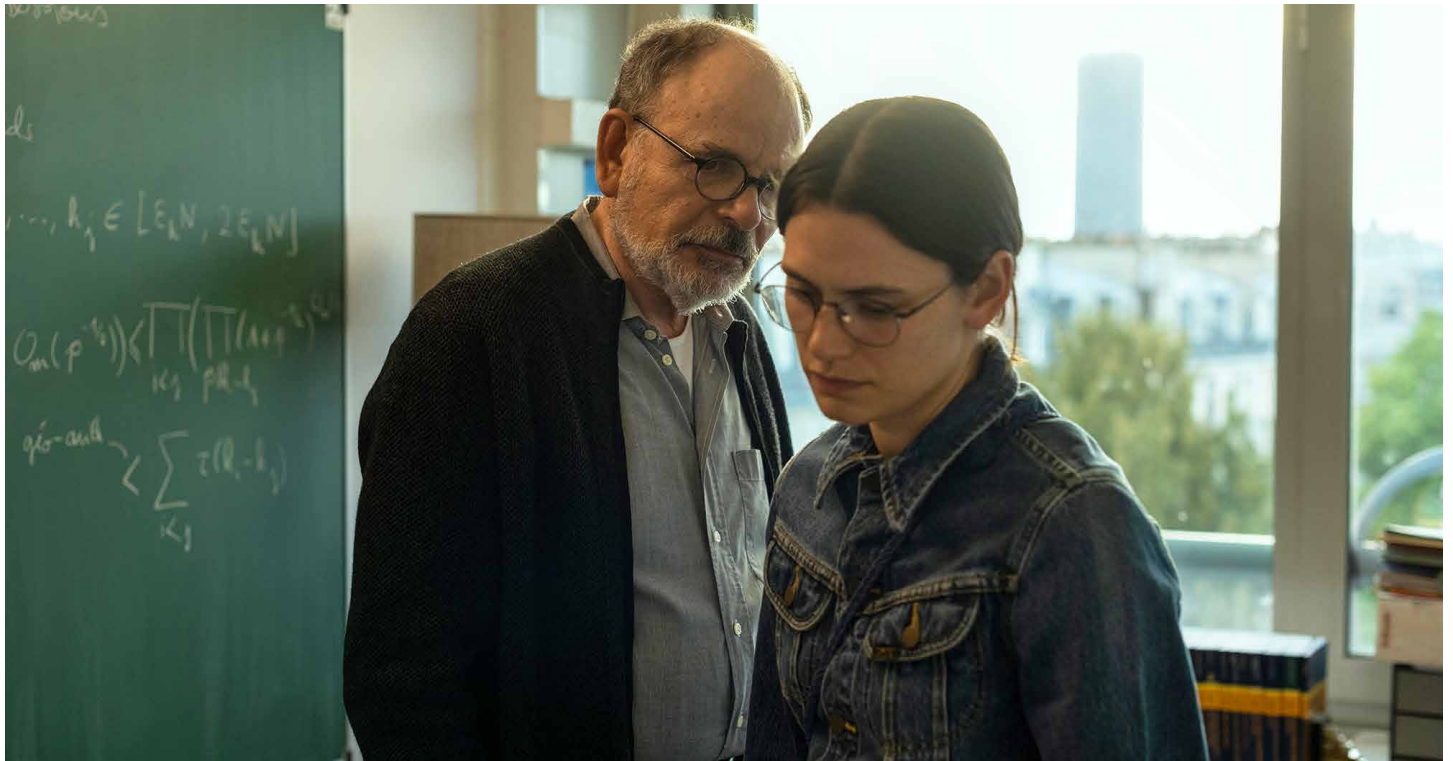390 47 69

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OUTSIDE THE BOX

Chemin du Martinet 28

1007 Lausanne

info@outside-thebox.ch

+41 21 635 14 34

The future of Marguerite, a brilliant student in Mathematics at the prestigious Ecole Normale Supérieure, seems all planned out. Only woman from her promo, she is finishing a thesis she has to expose to an audience of researchers. On the D-day, a mistake shakens all her certainties and all her foundations collapse. Marguerite decides to quit everything to start all over again.

Interview with ANNA NOVION

Interview by par Philippe Paumier, mars 2023

The Ecole Normale Supérieure is a closed, mysterious place for outsiders. Why did you choose this setting as the starting point of the film?

When I begin a film, I always start from a feeling, a sensation that I have experienced, that intrigues me and that I want to explore. When I was about twenty years old, I got sick and I had to cloister myself for six months. Once I had recovered, I felt a gap with the people of my age, I did not share their carefree attitude anymore. I tried to find a way to express that disconnection with the world and with others. I thought about the "*grandes écoles*," those higher education establishments where students are sometimes cut off from the rest of the world, solely focused on their studies, and pretty quickly the field of mathematics seemed the most appropriate.

The world of mathematics - and by implication that of the *Ecole Normale Supérieure*, or ENS – has rarely been shown in films, and even less so with a mathematician heroine. My meeting with Ariane Mézard, one of the few and greatest French female mathematicians, was decisive. We became friends instantly, as if we "recognised" each other, which was deeply moving. She is sensitive, straightforward, honest, and affable. She radiates an impressive strength contained in a great deal of vulnerability, an obvious self-confidence that nevertheless always seems to apologize for being there.

She was the first person who ever talked to me about mathematics in an artistic way, by conjuring up poetry, imagination, everything that drives me as a filmmaker. While she was telling me about her passion, she was also telling me about mine. Gilles Deleuze quite rightly said that a scientist invents and creates as much as an artist... With my co-writer Mathieu Robin, we invented a character that was very much inspired by Ariane and who, at the same time, said a lot about myself.

When you are a director, you must never let go. I see the same eagerness in Marguerite, a form of selflessness, a passion that mirrors mind. Another similarity between us is the level of commitment and resilience that our jobs require. Mathematicians might spend their whole lives trying to solve a problem with no assurance that they ever will. Filmmakers also risk seeing their projects break down at any moment. It is not unlike an act of faith. Being a mathematician is like joining a religious order. Incidentally, the ENS looks like a cloister where they have seminars... Il the film, Marguerite has a really pure relationship with mathematics, a form of devotion.

Werner isn't only a mentor to Marguerite, he is also a point of reference for her about this "religion." In his view, "mathematics should be devoid of feelings."

Mathematics is an ultra-competitive field. Searchers are aware that they belong to an elite. Werner definitely is. He is ambitious, and he thinks that his talent hasn't been truly appreciated. This has made him resentful. He still has faith in mathematics, but he is eaten away by frustration.

Werner is a power figure who prevents Marguerite from completely fulfilling her potential. Since the day she entered the ENS, she has seen him as a protector; in her view, their relationship involves feelings, whereas he only wants to put some distance between them. She wants him to like her, like in a daughter-father relationship. Only, Werner cannot do that, and it is not his role to play. At some point, Marguerite feels betrayed by him. I am

not passing judgement – Marguerite isn't the victim nor Werner the persecutor. They both have their own truths.

The theme of filiation is central to all your films. How do you explain it?

It has to do with my personal history, and probably with my relationship with my father. It is no coincidence that my films begin with characters – here, those played by Jean-Pierre Darroussin and Ella Rumpf – who cling to their certainties, and who are afraid to open up. Then something happens that forces them to change course, to let go, and to turn their vulnerability into strength.

I like to take my characters through an initiatory journey, to watch them open up to the world, grow up, and free themselves from authority figures. In *Les Grandes personnes*, it is a teenager (Anaïs Demoustier) who distances herself from her father during a holiday on a Swedish island. In *Rendez-vous à Kiruna*, the story adopts the father's point of view, with recognition as an implicit theme. And in *Le Théorème de Marguerite*, Marguerite leads the narrative; she works hard to prove to Werner that she deserves to be there. This conviction fuels her anger. Little by little, Marguerite asserts what she expects from Werner: she wants to be considered a mathematician in her own right. She is not there just to meet quotas!

As in any coming-of-age story, Marguerite crosses paths with characters, Noa and Lucas, who will change the course of her life and whom she will influence as well...

Noa and Lucas are more in touch with life than Marguerite. Noa is a dancer, she expresses herself with her body, she turns it into art, whereas Marguerite has never taken care of herself. Noa storms into Marguerite's life like a little tornado, but they have things in common. They are both passionate about their jobs, they are not prejudiced, they are surprised at each other's differences, but each accepts the other as she is. Marguerite is amazed at Noa's outspokenness, and inspired by her freedom as a woman.

Lucas is more sociable and less serious than Marguerite, he studies to reach success and a form of glory. They are united by their passion for mathematics. Marguerite doesn't allow herself to dream bigger, she even thinks that asserting her femininity might depreciate her talent. At the ENS, she tried her best to blend in, to act like the boys who must hide their weaknesses and sensitivity.

Lucas struggles to convince Marguerite that having feelings will not weaken her. The problem for Marguerite is that feelings are inherently irrational, you cannot control them like some scientific demonstration. Their duo makes perfect material for a romantic comedy, or a comedy of remarriage with mathematics!

One of Marguerite's first sidesteps is when she makes love to a stranger she has picked up from the street. How did you come up with this surprising and hilarious scene?

With Mathieu, we had a lot of fun inverting the usual codes of seduction. Marguerite is unwittingly subversive: by following Yanis in the street, she becomes a kind of creepy predator! She also takes risks, yet she is not afraid. This is what makes her so funny sometimes: she says and does things nobody else would.

I had this in mind when I shot and edited the scene with Yanis. When sex scenes are just about the sex, I find them embarrassing. It has nothing to do with prudishness, it is a matter of narrative pertinence. That scene shows that Marguerite is seeking her own pleasure regardless of her partner. And Yanis just looks at her, rather puzzled, wondering who is this determined woman on top of him!

Then Marguerite bursts onto another scene, just as unexpected: that of Mah-jong games!

And I am no more a mah-jong player than a mathematician! With Mathieu, we thought a lot about one of the pivotal points in the film: how will Marguerite reconnect with her passion for mathematics after leaving the ENS? We realised that the greatest mah-jong players are often mathematicians; you need extraordinary intellectual capacities to win at this game. It was the perfect fit for Marguerite.

I liked the idea of putting her back into another male-dominated field, in which players immediately think that she doesn't belong, that she will never match the men.

Marguerite's refusal to lose, both in the game or in her research, draws her to the edge of the abyss. Is this a way to tackle the madness that awaits all geniuses?

I wanted to make the viewer feel that dizziness, and to show that Marguerite might stray off course because of her pride, and lose herself eventually. Every mathematician has a story to tell about a college who became crazy, schizophrenic, who never recovered from a mistake, or who committed suicide. Their job requires so much work that their brains might implode. People who are extraordinarily quick-witted want to be at the top of their game all the time; it brings about constant exhilaration but also lots of pressure. It is akin to the experience of top athletes.

How did you choose Ella Rumpf, who was brought to the public's notice by Raw, and seen recently in *Tokyo Vice*?

I didn't make her audition for the part. When we met, we talked a lot, I looked at her, and I just knew. I got the feeling that there could be a fascinating connection between Ella and the character, and that it would give birth to an enthralling Marguerite. She exuded an intensity, an eagerness to commit that I wanted to film.

We wondered about the level of comedy we wanted to reach with this character. Marguerite is a bit of an oddball, but she is not a freak, we had to steer clear of any grotesque or caricatural treatment. We spent
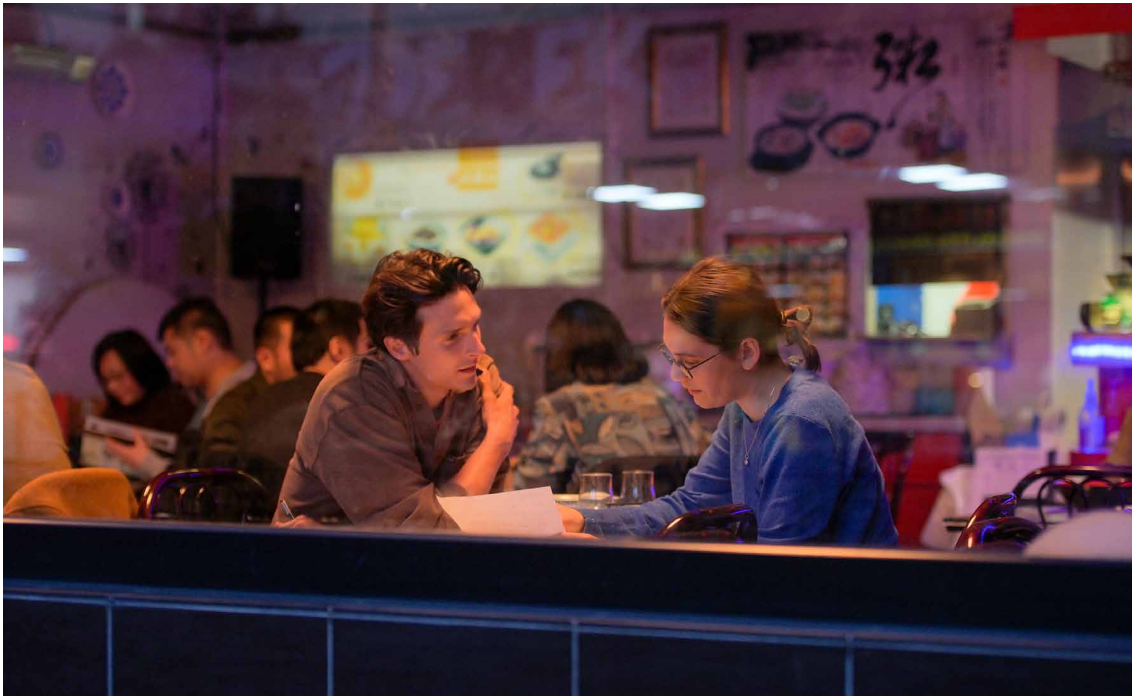
four months rehearsing and finetuning all the scenes to find the right balance. For instance, early in the film, Marguerite gives an interview. When she is asked about her hobbies, she literally answers: "I play Yahtzee with my mother." Her seriousness makes her funny.

Besides working with Ariane Mézard, who introduced her to the world of mathematics, their philosophy and their calligraphy, Elsa also got physically involved. I couldn't wait to film Marguerite's gait. It is at once awkward, slightly boyish, and purposeful. She couldn't care less about what other people think, I love that about her. We live in a world where people scrutinize each other, we are constantly being judged on social media. Showing someone who abstains from that daily tyranny is part of my discourse on our society.

Even though Marguerite is unconventional, she is a woman of today.

As well as a strong woman, with high intellectual skills. She is an example, in that she is a fierce and resilient fighter, in a male-dominated environment. It is hard to carve out a niche for yourself when you are constantly reminded of your gender; this peer pressure urges her to be the best. I have experienced it first-hand in my field, especially when I directed episodes of *The Bureau*. If you are the only woman to do this job, you must prove that you deserve it, because you are an exception, an anomaly.

I had never put myself out there so much in a film. It isn't autobiographical yet it is very personal, as to my relationship to the world and to work. On set, people would call me Marguerite and call Ella Anna all the time! You must be a warrior to succeed in this business. I share Marguerite's anger at things that I think are unfair in life. Marguerite is a little soldier who won't obey orders, who grows up and acquires great power. I hope her portrait will inspire women to fight for their passion.

Jean-Pierre Darroussin's portrayal of Werner's inflexibility and harshness is impressive, and this is an unusual register for him...

Great actors can thrive on all kinds of registers. But French cinema tends to confine them to the sort of roles that made them famous. For Jean-Pierre, it means nice, humane, immediately likeable characters. Having him play a rougher, tougher character makes his humanity even more enigmatic and it creates an ambivalence that is fascinating to film. Werner could have been an unpleasant and toxic character. Jean-Pierre gave him a more appealing, ambiguous, and nuanced dimension.

Jean-Pierre read many versions of the script, he watched the character grow, he has known Werner for a long time! After the long training phase, he rehearsed a lot with Ella to find their dynamics. Then on set it was just obvious: Jean-Pierre had understood who Werner needed to be. Someone who has no time to lose, including with feelings.

Why was it crucial to adjust your directing to Marguerite's journey?

My previous films were impressionistic, the feelings emerged slowly and had to be accompanied in delicate strokes, via lengthy shots. Marguerite is more blunt, more straightforward, which called for a more expressionistic directing. It starts with the monochromic and quiet ENS. The frames are geometrical, to match the order that prevails in this institution. Then disorder and irrationality gradually find their way into Marguerite's life. There are more colours, more handheld shots, more movements, and the camera seems lighter.

Mathematicians also talk about fun and experimentation. They enjoy spending their time solving enigmas. I wanted to show that childlike quality. It is the first time I intentionally opted for a playful tone. I was inspired by a certain category of American cinema that takes the viewers' pleasure into account and that makes sure not to frustrate them. When I watch films by Paul Thomas Anderson, the

Coen brothers, or Tarantino, I can feel their glee. I also had American references in mind for the performance of Marguerite's character: Elle Fanning, Emma Stone, Saoirse Ronan.

In Europe, we tend to favour a more naturalistic style of acting, we seek diehard realism, to the point that we erase mischief from performances. I opted for an ever-moving directing style, to mimic Marguerite's brain, which is restless. The film channels the mental energy of the character.

You even manage to make mathematics cinematographic!

It was yet another challenge direction-wise. How could we make mathematics nobody understands look organic? I had to embrace Marguerite and Lucas' passion. They are both workaholics. Ignoring that fact would have

been deceitful, not to forget disrespectful towards mathematicians. When they paint the living room walls black to write equations, I wanted it to looks as if they were painting the Sistine Chapel! Those writings are like hieroglyphs, they are fascinating to look at, there is beauty in that abstraction.

The equations that are shown on the film are all genuine, Ariane Mézard made sure of it. Marguerite wants to solve Goldbach's conjecture, a problem that hasn't been solved yet. The crazy thing is that Ariane actually made some breakthroughs while she was working on it ahead of the shooting. The future mathematicians who will try to demonstrate Goldbach will be able to watch the film and find some key elements in it!

Marguerite's energy that you just mentioned is echoed by the soulful music. How did Pascal Bideau compose it?

We've worked together since Les Grandes personnes. Pascal started out with a somehow mathematical, cerebral score that sounded like Philip Glass, but we realised it didn't add anything to the image. I kept thinking about Stromae's "L'Enfer," a song about his suicidal thoughts. It dawned on me that what moved me was the Bulgarian choir at the beginning of the song.

It suddenly clicked, Pascal and I realised that we needed a lyrical, expressive music to convey the richness of Marguerite's soul, the hypersensitivity she tries to hide. The music Pascal composed contributes to the emotional pulse of the narrative, and to the understanding of the character.

The film will premiere at Cannes as part of the Official Selection. How does that make you feel, fifteen years after Les Grandes personnes being screened at the Critics' Week?

I am excited. When Les Grandes personnes was shown, I was 28 years old. It brought about euphoria and chills, it seemed unreal and there was also a sense of achievement, as if my dream had come true. I was a budding director then, and this selection strengthened my belief that I could make a place for myself in the cinema world. Of course, once this magic moment was over, I realized that it was just one step, that I needed to get back to work. Such highs never last long.

Today, I have the benefit of hindsight, I am already thinking about what comes next. What is so reassuring about being selected in the greatest film festival of the world is that it shows you that you were right not to give up! There are so many moments in a director's life when you wonder if it's reasonable to fight so hard to tell a story. Cannes sweeps away those doubts, at least for a while. Also, I'm going to meet my first audience, and I know that to me, it will be the most moving experience in the whole festival.

Interview by Philippe Paumier, April 2023

ARIANE MÉZARD, Mathematics Advisor

Marguerite Hoffman is my eighth PhD student. An imaginary student. There are already imaginary mathematicians, if only Nicolas Bourbaki. But Marguerite is a young woman. A young woman who loves mathematics. Marguerite's potential was obvious. She carried the possibility to introduce a wide audience to research in mathematics, and to offer a new incarnation, a female model. Marguerite would be a mathematician, a heroine with a singular journey, a young woman who chooses her life.

I was already familiar with the process proposed by Anna Novion. First, find a thesis topic, then work on the bibliography, find the thought process towards the thesis result, and finally defend the resulting theorem and present it to various audiences. My chosen field, the deformations of Galois representations, was not right for Marguerite, because it was not convenient for cinema, it could not be "shown" properly. I tried to prove otherwise, by summoning up Andrew Wiles, one of our heroes. Then Anna suggested that Marguerite's childhood dream be Goldbach's pyramid. What a bold choice for Marguerite, quite simply working on Goldbach's conjecture!

We worked for three or four years, just like for a PhD. Anna would submit ideas for the script that needed to be adapted to mathematics, as a text might be put to music. I was horrified when I had to come up with a mistake. A mistake in a mathematics presentation is like a death sentence. Marguerite – so young, so bright, and already finished!
Finally, I met Marguerite in the person of Ella Rumpf. I am not sure which one of us was the most intrigued, the student or the teacher, the actress or the technical advisor? Ella was determined, and she shared with Anna and I the will to shine a light on challenging mathematics, even if it meant tackling the work of Fields medal winners Timothy Gowers (1998), Terence Tao (2006) or James Maynard (2022, two months after the shooting). And then the magic happened. Within three months, I saw Ella change radically. She entered the ENS, together with her fellow travellers, PhD students Coline, Vadim, Romain, Anthony, and Béranger, who were doing it for real. We saw her scribbling equations with a fountain pen or a chalk, unaware that it was "method acting."

Jean-Pierre Darroussin's training lasted for a month. We adapted to another method. The actor only gets into character into the action/cut intervals set by the director. Before that, he is just observing, he is not the part. Jean-Pierre is Jean-Pierre. He would ask me about homotopy groups in the courtyard at the ENS; he surprised the students of the drama club hidden at the back of the school; he could be found hanging out in the common room at one in the morning. As for Julien Frison, he learnt Lucas' math formulas unbelievably fast, using twisted mnemonic technics. He made a point of understanding their scientific content and emotional value.

Then it all went very fast. We got caught in the whirlwind of the shooting. My own office turned into a dressing room, a lair for PhD students, a film set. The only place left untouched was room W, a lecture room with a presentation of the prime number theorem. For once, chalks were the centre of attention, beyond their regular users. Professionals were taking an interest in their unique sound, their intense whiteness, their reflection of light. In between takes, the art department would pamper them. Some of the chalks were even put makeup on to become fluorescent.

Those moments with the crew were quirky and joyful for all of us, not just for the chalks. All together, we tried to transcribe the pleasure that stems from mathematics research, scientific excellence, self-transcendence, creative freedom, confrontation with others, human fulfilment, and self-realisation.
This tremendous collective experience was sensitively orchestrated by Anna Novion, who turned mathematics into a beautiful and poetic cinematic object.

ANNA NOVION'S Biography

Anna Novion is a French-Swedish director. After three short films, *FRÉDÉRIQUE EST FRANÇAISE* (2001), *CHANSONS ENTRE DEUX* (2002) and *DON'T GO TO THE SEA WHEN YOU DON'T KNOW IT* (2005), she directed her first feature film, *GROWN UPS* (2007), with Jean-Pierre Darroussin and Anaïs Demoustier, selected at Cannes Critics' Week in 2008. She then directed *RENDEZ-VOUS IN KIRUNA* (2013), shot between France and Sweden, and received the Golden Pyramid at Cairo Film Festival. More recently, she directed several episodes of seasons 4 and 5 of *THE BUREAU*, a successful series on Canal+.

Marguerite	ELLA RUMPF
Laurent Werner	JEAN-PIERRE DARROUSSIN
Suzanne	CLOTILDE COURAU
Lucas	JULIEN FRISON de la Comédie Française
Noa	SONIA BONNY

Direction	ANNA NOVION
Script	ANNA NOVION, MATHIEU ROBIN, MARIE-STÉPHANE IMBERT AND AGNÈS FEUVRE
Dialogue Adaptation	MATHIEU ROBIN ET ANNA NOVION
Producers	MILÉNA POYLO & GILLES SACUTO (TS PRODUCTIONS)
Co-Producers	ALINE SCHMID & ADRIAN BLASER (BEAUVOIR FILMS)
Image	JACQUES GIRAULT
Editing	ANNE SOURIAU
Original Music	PASCAL BIDEAU
Production Designer	ANNE-SOPHIE DELSERIES
Casting	BRIGITTE MOIDON - ARDA, FRANÇOIS GUIGNARD - ARDA
Sound	MARC VON STÜRLER, BÉATRICE WICK, ROMAN DYMNY
Unit Production Manager	SOPHIE LIXON
Associate Producer	CONSTANCE PENCHENAT
Assistant Director	FRANCK MORAND
Script Supervisor	ALEXIA CHASSOT
Mathematics Advisor	ARIANE MÉZARD
Costumes	CLARA RENÉ
Make Up	MARIE GOETGHELUCK
Location Manager	ROMAIN BYACHE
Posproduction Manager	DELPHINE PASSANT
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