Material for the *Annual Report 2016*

Christer O. Kiselman

1. Writings

1.1. Six publications (registered in DiVA)

During 2016, I have authored six publications: three scientific articles (16-1, 16-a, 16-b), two obituaries (16-i, 16-ii), and one short presentation of a book on mathematical terms (16-iii).

16-1. Weak lineal convexity. **In:** Białas-Cież, Leokadia; Kosek, Marta, Eds. *Constructive Approximation of Functions.* Banach Center Publications, Polish Academy of Sciences, volume 107, pp. 159–174. ISBN 978-83-86806-30-0. *MathSciNet, Mathematical Reviews* MR3496853. [Published in March 2016.]

16-a. Lingva riĉo kaj la postuloj de la terminologio [The riches of languages and the requirements of terminology]. **In:** Gobbo, Federico, Ed. 2016. *Lingua, politica, cultura. Serta gratulatoria in honorem Renato Corsetti*, pp. 125–135. New York, NY: Mondial. ISBN 9781595693259.

16-b. La jidogramatiko de Zamenhof kaj lia Lingvo universala. Mallonga versio [Zamenhof's Yiddish grammar and his Universal Language. Short version]. **In:** Košecký, Stanislav, Ed. 2016. *Prilingve en Nitro: politike, historie, teorie, instrue. Fakaj prelegoj prezentitaj kadre de la 101-a Universala Kongreso de Esperanto*, pp. 159–175. Rotterdam: Universala Esperanto-Asocio. ISBN 978-92-9017-130-0.

16-i. Olle Hanner på Stockholms högskola. **In:** *Bulletinen. Svenska matematikersamfundets medlemsblad*, 2016 February 15, p. 27.

16-ii. Gennadi Henkin (1942–2016). Some memories. **In:** *Bulletinen. Svenska matematikersamfundets Bulletin*, 2016 October 15, pp. 37–44.

16-iii. Matematiktermer för skolan [Mathematical terms for school use. A presentation of the book *Matematiktermer för skolan*, published in 2008.] **In:** Hanson, Bo, Ed. 2016. *Insikt och handling*, volume 25 (2016). *Tema: Lexikon över lexikon*, pp. 53–54. Göteborg: Hans Larsson Samfundet. ISBN 978-91-639-2657-0, ISSN 0436-8096.

1.2. Seven articles accepted for publication (registered in DiVA)

1.2.1. Mikael Passare (1959–2011)

To appear in *Analysis Meets Geometry. The Mikael Passare Memorial Volume.* Basel: Birkhäuser. ISBN 978-3-319-52469-6.

Figure 1.2.1. Mikael Pettersson (age 24), Jean François Colombeau, Leif Abrahamsson, and Urban Cegrell in November 1983. Mikael changed his family name to Passare in 1984. (Photo Christer Kiselman)

1.2.2. Mikael Passare's publications

To appear in *Analysis Meets Geometry. The Mikael Passare Memorial Volume*. Basel: Birkhäuser. ISBN 978-3-319-52469-6.

1.2.3. *Curriculum Vitae:* Mikael Passare

To appear in *Analysis Meets Geometry. The Mikael Passare Memorial Volume*. Basel: Birkhäuser. ISBN 978-3-319-52469-6.

1.2.4. Convexity of marginal functions in the discrete case (joint with Shiva Samieinia)

To appear in *Analysis Meets Geometry. The Mikael Passare Memorial Volume*. Basel: Birkhäuser. ISBN 978-3-319-52469-6.

Figure 1.2.4. Shiva Samieinia.

1.2.5. Language choice in theses in mathematics at Uppsala University and in a Nordic journal

Accepted for publication in *Normat*, volume **61**, No. 2.

1.2.6. Werner Fenchel, a pioneer in convexity theory and a migrant scientist

Accepted for publication in *Normat*, volume **61**, No. 2.

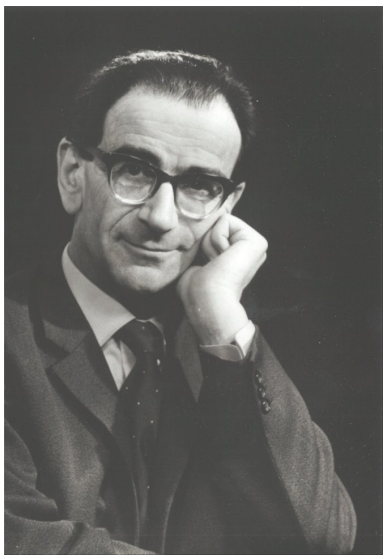

Figure 1.2.6. Werner Fenchel (1905–1988).

1.2.7. Akademio de Esperanto fronte al novaj taskoj

Manuscript based on a presentation during the Conference on Esperanto Studies in Buenos Aires on 2014 July 31, organized by Esther H. Schor and José Antonio Vergara.

1.3. Two submitted manuscripts

- Domains of holomorphy for Fourier transforms of solutions to discrete convolution equations (17 pages).
- How to best fold a triangle (23 pages).

1.4. Editorial work

- Editor, together with Mats Andersson, Jan Boman, Pavel Kurasov, and Ragnar Sigurdsson, of a book entitled *Analysis Meets Geometry. The Mikael Passare Memorial Volume*. Basel: Birkhäuser. ISBN 978-3-319-52469-6.

  Period: 2011–2017.
- Editor, *Esperantologio / Esperanto Studies*, Issue No. **8**.

  Period: 2015–2017.

2. Four invited talks

2.1. Atelier de Bamako

I participated in *Atelier de Bamako*, organized by the *Réseau EDP – Modélisation – Contrôle* during 2016 January 11–15 at Université des Sciences, des Techniques et des Technologies de Bamako, USTTB, Bamako I. Invited plenary lecture on 2016 January 13: *Convolution discrète, la transformation de Fourier et sa correspondante tropicale : la transformation de Fenchel*.

2.2. The World Congress of Esperanto in Nitra

The 2016 World Congress of Esperanto was held in Nitra 2016 July 23–30. As a part of this congress, a conference on Esperanto Studies was organized on July 29, to which I was an invited speaker. My presentation had the title *La jidogramatiko de Zamenhof kaj lia Lingvo universala* [*Zamenhof's Yiddish Grammar and his Universal Language*].

2.3. Analysis Day in Memory of Mikael Passare

A one-day conference at Stockholm University 2016 October 05. Invited talk: *Gennadi Henkin (1942–2016). Some memories*.

2.4. Advances in Mathematics and Its Applications, Kampala

I was invited as a plenary speaker at the conference *Advances in Mathematics and Its Applications* at Makerere University in Kampala, October 26–28. The talk, given on October 27, was entitled *Discrete convolution operators, the Fourier transformation, and its tropical counterpart, the Fenchel transformation*.

3. Docent Lecture

Figure 3. Xiaoqin Wang.

Xiaoqin Wang gave her Docent Lecture on January 14 at the University of Gävle, where she has a position as Senior Lecturer. In May she received the title of *Docent*. She got her PhD at Uppsala University in 1990 with me as advisor.

4. PhD thesis advising

Since my first visit to Bamako in 2011 and up to the beginning of 2016, I have been the principal scientific advisor of Adama Arouna Koné, Université des Sciences, des Techniques et des Technologies de Bamako, USTTB, Bamako I. His advisors in Bamako have been Ouaténi Diallo and Diby Diarra. Gunilla Borgefors has been advisor in Uppsala.

Adama presented his thesis, entitled *Géométrie digitale utilisée pour la discrétisation et le recouvrement optimal des objets euclidiens* (114 pages), on January 14. The *rapporteurs* were Fana Tangara and Sado Traoré. The thesis was approved by the jury, chaired by Professor Hamidou Touré, Ouagadougou, with the highest mark, *Très honorable*.

Figure 4A. Adama Arouna Koné.

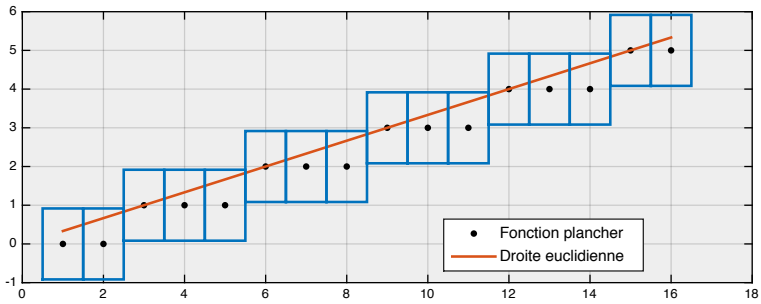

Figure 4B. Covering the Euclidean straight line of equation $y = \frac{1}{3}x$ by a dilation with structural set equal to the rectangle $[-\frac{1}{2}, \frac{1}{2}] \times [-\frac{5}{6}, \frac{5}{6}]$ (courtesy Adama Arouna Koné).

5. Seminar at VI2

On May 15, I gave a seminar at the Division of Visual Information and Interaction of the Department of Information Technology entitled *Language choice in theses in mathematics at Uppsala University and in a Nordic journal; Werner Fenchel, a pioneer in convexity theory and a migrant scientist.*

6. Language studies

Figure 6. Jan Schwarz and Helen Beer.

6.1. Lund University

During the Fall Semester 2015 and the Spring Semester 2016, I have studied Yiddish language and literature at Lund University, courses led by Jan Schwarz and Delia Kübeck. I have obtained a total of 30 ECTS Credit Points.

6.2. Yiddish Summer Weimar

I participated in a seven-day workshop, July 17–23, in Weimar, comprising 35 hours, led by Helen (Khayele) Beer, University College of London. There were lots of artistic preformances in the evenings.

7. Committee assignments

7.1. The International Science Programme

The International Science Programme (ISP) has activities in three fields, one of which is mathematics.

Figure 7.1A. Leif Abrahamsson.

Leif Abrahamsson is the director of the International Programme in the Mathematical Sciences (IPMS). I am a member of the Reference Group for Mathematics since 2002.

Figure 7.1B. Ameenah Gurib-Fakim.

Her Excellency Ameenah Gurib-Fakim, President of the Republic of Mauritius, met officials of the International Science Programme and members of its Reference Groups on September 08.

The Reference Group for Mathematics met in Kampala and discussed the evaluation process of the network *East African Universities Programme* (EAUMP), October 24–30.

7.2. Center for Research and Documentation on World Language Problems

- I am a member of a committe to judge grant applications to the Center for Research and Documentation on World Language Problems (CED) concerning research on Esperanto and interlinguistics, 2006-12-30 — .

- I am a member of the board of the Center for Research and Documentation on World Language Problems, 2013 — .

7.3. The 19th IAPR International Conference on Discrete Geometry for Computer Imagery, DGCI

The 19th DGCI was held 2016 April 18–20 in Nantes. I was a member of the Program Committee and also a member of a committee to award a prize for the best student paper.

7.4. International Symposium for Mathematical Morphology, ISMM

The next ISMM is planned for 2017 May 15–17 in Fontainebleau. I am a member of the Program Committee, appointed in November 2016.

8. Participation in conferences without giving a talk

During 2016 I have participated in seven conferences without giving a talk:

- The Swedish Society for Automated Image Analysis, SSBA: Conference in Uppsala, March 15–16.
- A conference at Lund University on Yiddish language, literature, and culture, organized by Jan Schwarz, April 03.
- *Discrete Geometry for Computer Imagery*, DGCI 19, in Nantes, April 18–20.
- *The Crafoord Prize Symposium in Mathematics 2016*, organized by the Royal Swedish Academy of Sciences at the Royal Institute of Technology, Stockholm, May 25. The mathematics laureate was Yakov Eliashberg.
- *The Abel Symposium*, organized by the Royal Swedish Academy of Sciences at the Royal Institute of Technology, Stockholm, May 27.
- A conference in Stockholm on Esperanto literature led by Giorgio Silfer, June 18.
- *Algebraic Mini-Conference in Honor of Ernst Dieterich and Karl-Heinz Fieseler*, organized by the Department of Mathematics, Uppsala University, September 15.

9. Visitors

Giorgio Silfer and Perla Martinelli from the Cultural Esperanto Center, La Chaux-des-Fonds, visited me on June 16 and 17 for discussions on Esperanto and its literature.

10. Visits

10.1. Jean Serra

Figure 10.1. Jean Serra.

Jean Serra and Marie-Françoise Colomé-Serra accepted me in Fontainebleau, April 20–22, for interesting discussions on mathematical morphology and many other subjects.

10.2. Paris Yiddish Center – Medem Library

Tal Hever-Chybowski and Yitskhok Niborski of the *Maison de la culture yiddish et la bibliothèque Medem* in Paris accepted me on April 23 for discussions on Yiddish grammar.

Figure 10.2. Tal Hever-Chybowski and Yitskhok Niborski.

10.3. Dan Shechtman

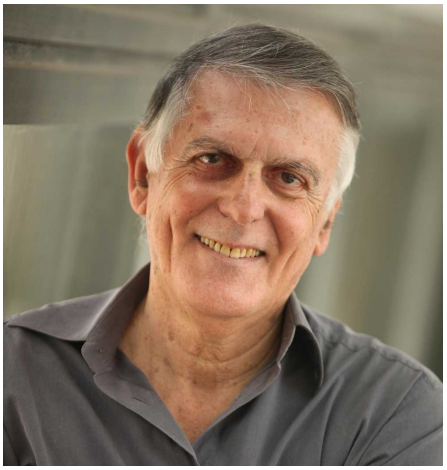

Figure 10.3. Dan Shechtman.

Dan Shechtman of Technion in Haifa accepted me on August 23 for a long and interesting conversation on quasicrystals and many other topics.

11. Nine current research projects

11.1. Complex convexity

Project manager: Christer Kiselman.

Project abstract: A bounded open set with boundary of class C^1 which is locally weakly lineally convex is weakly lineally convex, but, as shown by Yuriĭ Zelinskiĭ, this is not true for unbounded domains. We construct explicit examples, Hartogs domains, showing this. Their boundary can have regularity $C^{1,1}$ or C^∞.

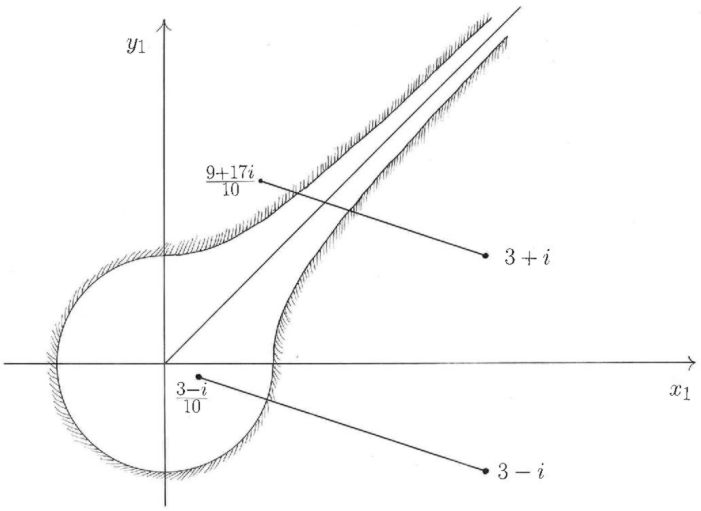

Figure 11.1. The base in the complex plane of a locally lineally convex set in $\mathbf{C}^2$ which is not lineally convex (from (16-1); courtesy Hania Uscka-Wehlou).

Obstructions to constructing smoothly bounded domains with certain homogeneity properties are presented.

A current activity is a study of one-sided regularity of subsets of $\mathbf{R}^n$ or $\mathbf{C}^n$. Preliminary results on this kind of regularity were presented at a conference on 2015 September 16.

Period: 1967-10-01 — .

Financed by: Université de Nice 1967-10-01 — 1968-09-30;
Uppsala University 1968-10-01 — 2006-04-30;
Kingdom of Sweden 2006-05-01 — .

Publications: There are several publications in this project. The latest paper was published in March 2016 (16-1).

11.2. Elements of Digital Geometry, Mathematical Morphology, and Discrete Optimization

Project manager: Christer Kiselman.

Project abstract: A book on fundamentals of three related fields of knowledge: digital geometry, mathematical morphology, and discrete optimization.

I have received an invitation to talk at the *First Network meeting for Sida- and ISP-funded PhD Students in Mathematics* to be held 2017 March 07–08 at Sida's office in Stockholm. Linköping University and the International Science Programme are the organisers.

Partners: Hania Uscka-Wehlou, Shiva Samieinia, Adama Arouna Koné; possibly others.

Period: 2002 — .

Financed by: Christer: Uppsala University 2002 — 2006-04-30;
Kingdom of Sweden 2006-05-01 — .
Hania: Man In The Middle AB (MITM).
Shiva: Stockholm University; The Ruth and Nils-Erik Stenbäck Foundation.
Adama: International Science Programme (ISP) 2011–2016;
Université des Sciences, des Techniques et des Technologies de Bamako, USTTB, Bamako I, 2011 — .

11.3. How to best fold a triangle

Project manager: Christer Kiselman.

Project abstract: We fold a triangle once along a straight line and study how small the area of the folded figure can be. It can always be as small as the fraction $2-\sqrt{2}$ of the area of the original triangle. This is best possible: For every positive number ε there are triangles that cannot be folded better than $2-\sqrt{2}-\varepsilon$.

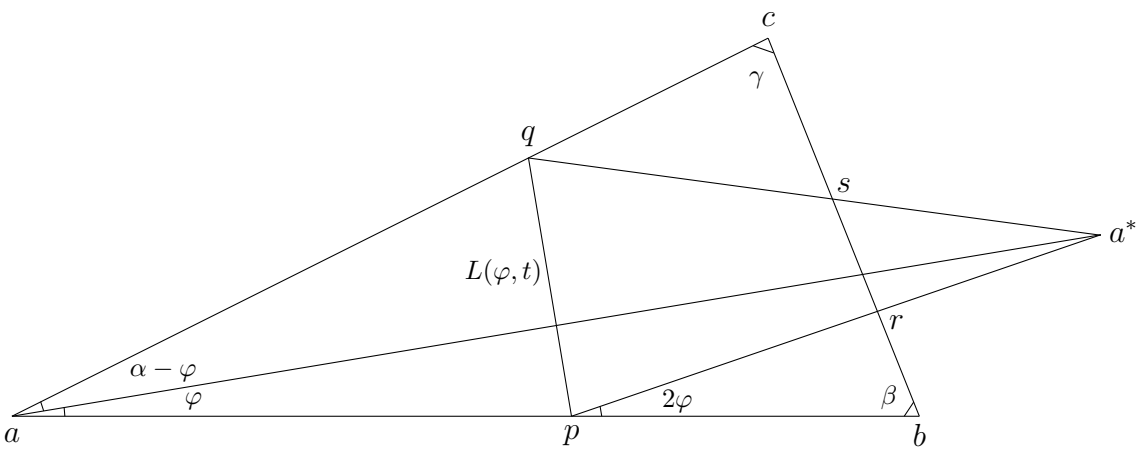

Figure 11.3. The original triangle $T(a, b, c)$ has its vertices at a, b and c. We fold it along a line, denoted by $L(\varphi, t)$. The folded object is a heptagon with vertices at p, b, r, a^*, s, c, q, where a^* is the reflection of a in the line $L(\varphi, t)$. The doubly covered set is a quadrilateral $Q(p, r, s, q)$ with vertices at p, r, s, q.

Period: 2005-04 — .

Partner: Bo Senje.

Financed by: Uppsala University 2005 — 2006-04-30;
Kingdom of Sweden 2006-05-01 — .

Publication: A manuscript was submitted on 2016 December 28.

11.4. Existence of continuous right inverses to linear mappings in elementary geometry

Project manager: Christer Kiselman.

Project abstract: A linear mapping of a compact convex subset of a finite-dimensional vector space always possesses a right inverse, but may lack a continuous right inverse even if the set is smoothly bounded. Examples showing this are given as well as conditions guaranteeing the existence of a continuous right inverse, also for other sets.

Period: 2005-09-08 — .

Partner: Erik Melin; possibly others.

Financed by: Christer: Uppsala University 2005 — 2006-04-30;
Kingdom of Sweden 2006-05-01 — .
Erik: Uppsala University 2005–2008.

Publications: A manuscript by Erik Melin and me is in preparation.

11.5. Convexity of marginal functions in the discrete case

Project manager: Christer Kiselman.

Project abstract: We define, using difference operators, classes of functions defined on the set of points with integer coordinates which are preserved under the formation of marginal functions. The duality between classes of functions with certain convexity

properties and families of second-order difference operators plays an important role and is explained using notions from mathematical morphology.

					↑							
	8	7	6	5	4	3	2	1	0	1	2	
	6	5	4	3	2	1	0	1	2	3	4	
—	4	3	2	1	0	1	2	3	4	5	6	→
	2	1	0	1	2	3	4	5	6	7	8	
	0	1	2	3	4	5	6	7	8	9	10	
	2	3	4	5	6	7	8	9	10	11	12	
					|						
h	0	1	0	1	0	1	0	1	0	1	0	

Figure 11.5. Define $f(x, y) = |x - 2y|$, $(x, y) \in \mathbf{Z}^2$, a convex extensible function, and let $h(x) = \inf_{y \in \mathbf{Z}} f(x, y)$, $x \in \mathbf{Z}$, be its marginal function. We see that h is not convex in any sense of the word.

Several generalizations are now being studied.

Period: 2010-01-11 — .

Partner: Shiva Samieinia, formerly at the Royal Institute of Technology (KTH); now at Stockholm University.

Financed by: Christer: Kingdom of Sweden.
Shiva: The Royal Institute of Technology;
Stockholm University;
The Ruth and Nils-Erik Stenbäck Foundation.

Publications: An article (10-4), joint with Shiva, was published as a part of her PhD thesis. A joint manuscript was accepted on 2015 April 11.

11.6. Digital hyperplanes

Project manager: Christer Kiselman.

Project abstract: Digital planes in all dimensions are studied. The general goal is to generalize to any dimension the results of Kiselman's 2011 paper in *Mathematika* (11-1).

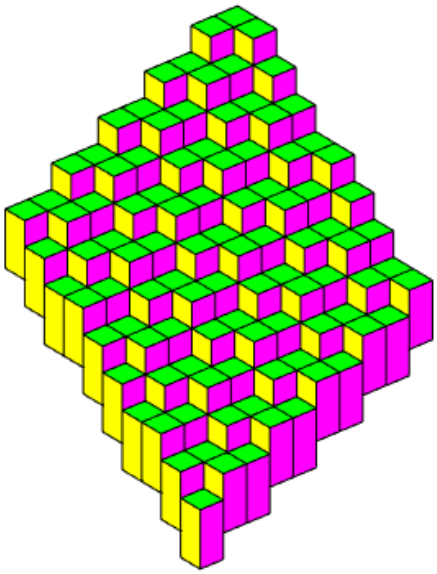

Figure 11.6. Covering a Euclidean plane by a dilation with structural set equal to the box $[-\frac{1}{2}, \frac{1}{2}] \times [-\frac{1}{2}, \frac{1}{2}] \times [-\frac{9}{8}, \frac{9}{8}]$ (courtesy Adama Arouna Koné).

An important part of the study was finished with Adama's thesis, presented on 2016 January 14. There are, however, several possible generalizations which are now being investigated.

Period: 2010-01-11 — .

Partner: Adama Arouna Koné, Université des Sciences, des Techniques et des Technologies de Bamako, USTTB, Bamako I.

Financed by: Christer: Kingdom of Sweden.
Adama: International Science Programme (ISP) 2011–2016;
Université des Sciences, des Techniques et des Technologies de Bamako, USTTB, Bamako I 2011 — .

Publication: Koné, Adama Arouna. 2016. *Géométrie digitale utilisée pour la discrétisation et le recouvrement optimal des objets euclidiens* (114 pages).

11.7. Discrete convolution equations

Project manager: Christer Kiselman.

Project abstract: We study solvability of convolution equations for functions with discrete support in $\mathbf{R}^n$, a special case being functions with support in the integer points. The more general case is of interest for several grids in Euclidean space, like the body-centred and face-centered tesselations of three-space, as well as for the non-periodic grids that appear in the study of quasicrystals. The theorem of existence of fundamental solutions by de Boor, Höllig & Riemenschneider is generalized to general discrete supports, using only elementary methods. We also study the asymptotic growth of sequences and arrays using the Fenchel transformation. Estimates using the Fourier transformation are studied.

Now duality of convolution will be investigated.

A study of quasicrystals is part of this project.

Period: 2012-01-11 — .

Financed by: Kingdom of Sweden.

Publications: A paper was published on 2015 May 07 in *Mathematika* (15-2). A second paper was submitted on 2015 December 31.

11.8. Zamenhof's Yiddish grammar

Project manager: Christer Kiselman.

Project abstract: Zamenhof wrote a Yiddish grammar (in Russian) around 1880. It was published in full only in 1982. A study of this grammar is now being undertaken. In particular, a comparison with his language project *Universal Language* from about the same time is of interest.

Figure 11.8. L. Zamenhof (1859–1917) around 1879.

A presentation (in Esperanto) in Nitra took place on July 29.

I have received an invitation to present the project (in English) at a conference at Polin, Warsaw, 2017 December 13–15.

Period: 2015-08-01 — .

Financed by: Kingdom of Sweden.

Publications: A short presentation was published in November 2016 (16-b). The full text has not yet appeared.

11.9. Mathematical concepts and their linguistic expression in a multicultural setting

Project manager: Hania Uscka-Wehlou.

Figure 11.9A. Hania Uscka-Wehlou.

Project abstract: To study the relation between mathematical concepts and their expression in several languages. Special attention is devoted to the use of non-native languages.

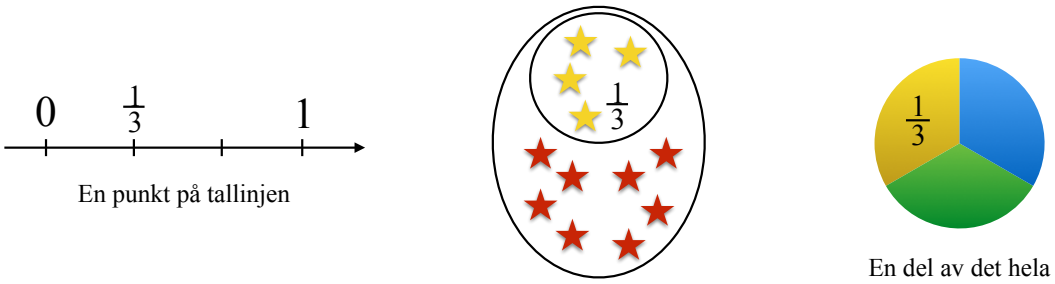

Figure 11.9B. The fraction one third can be represented in several ways (courtesy Hania Uscka-Wehlou).

Partners: Christer Kiselman, Adama Arouna Koné, Lars Mouwitz, Fanja Rakontondrajao, Amites Rasho, Shiva Samieinia, Xiaoqin Wang; possibly others.
Period: 2016-12-01 — .
Financed by: Hania: Man In The Middle AB (MITM).
Christer: Kingdom of Sweden.
Adama: Université des Sciences, des Techniques et des Technologies de Bamako.
Lars: Kingdom of Sweden.
Fanja: Université d'Antananarivo.
Shiva: Stockholm University;
The Ruth and Nils-Erik Stenbäck Foundation.
Xiaoqin: University of Gävle.
Publications: Several publications in Swedish and English are planned.

12. Three completed research projects

For some research projects finished earlier, see the background material for 2015.

12.1. Language choice in theses in mathematics at Uppsala University and in a Nordic journal

Project abstract: A study of language choice in doctoral thesis, showing the changes from Latin over Swedish to French, German and English.

Period: 1998–2016.

Publication: A paper is accepted for publication in *Normat*, volume **61**, No. 2.

12.2. Combination of word elements in Esperanto

Project manager: Christer Kiselman.

Project abstract: This is a study of word formation in Esperanto, with an historical survey and questions for the future.

Period: 2011-01-11 — 2016-12-31.

Publications: The project was essentially finished with the article (15-a).

12.3. Werner Fenchel, a pioneer in convexity theory and a migrant scientist

Project abstract: Werner Fenchel (1905–1988) was a pioneer in convexity theory and in particular the use of duality there. When asked about his views on the many terms used to express this duality he described in a private letter (1977) the whole development from Legendre and onwards, as well as his preferences concerning the choice of terms. A survey of basic notions of convexity theory is sketched, as well as the background for Fenchel's leaving Germany and moving to Denmark and later to Sweden.

Period: 2013–2016.

Publication: A paper is accepted for publication in *Normat*, volume **61**, No. 2.

13. Referee reports (not reported to Squirrel)

13.1. *Comptes Rendus*

Michèle Vergne asked about a manuscript. Report sent 2016 May 10.

13.2. *Journal of Mathematical Imaging and Vision*

Report sent on 2016 September 26. New submission November 14; report sent 2016 December 10.

13.3. *Comptes Rendus*

Michèle Vergne asked about a manuscript. Report sent 2016 October 03.

13.4. *Palestine Journal of Mathematics*

Simon K. Donaldson asked about a manuscript. Report sent 2016 October 10.

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