Symposium on
History of mathematics on the Number Zero
to be held in Phnom Penh, Cambodia
19-20 March 2019

Venue: Royal University of Phnom Penh (RUPP), Campus I
Russian Federation Boulevard, Toul Kork, Phnom Penh, Cambodia.

Objectives

The symposium on history of mathematics on the number zero will offer a forum for researchers, scientists and scholars working in the fields history of mathematics and mathematics education with the following objectives:

i. to share knowledge and discuss the history of zero numeral.
ii. to provide Cambodian mathematics educators with knowledge of history of mathematics and its evolution.
iii. to foster mathematics education in Cambodia, and to establish networking nationally and globally.
iv. to develop documentation for dissemination.
v. to promote research culture of mathematics (education) in Cambodia.

List of speakers of the Conference

1. Amir Alexander, UCLA, USA
2. Bill Casselman, University of British Columbia, Canada
3. Jean G. Dhombres, Research Director, CNRS , France
4. Jean-François Maheux, Université du Québec à Montréal, Canada
5. Kim Plofker, Union College, USA
6. Marina Ville, François Rabelais University, CNRS, France
7. Norman J Wildberger, UNSW Sydney, Australia
8. S. G. Dani, Centre for Excellence in Basic Sciences, India
9. Uk Solang, Switzerland
10. Amber Kunkel, Institute Pasteur of Cambodia, Cambodia
11. Ishaan Wadhwa, Prudential (Cambodia) Life Assurance PLC, Cambodia
12. Seam Ngonn, Royal University of Phnom Penh, Cambodia
13. Chhit Wornnarith, Royal Academy of Cambodia, Cambodia
14. Lin Mongkolsery, Institute of Technology of Cambodia, Cambodia
15. Sim Visoth, National Institute of Education, Cambodia
16. Chan Roath, Cambodian Mathematical Society, Cambodia

Co-chairs of the symposium

Hun Kanal, Royal University of Phnom Penh, Cambodia
Debra G. Aczel and Miriam Aczel, Co-founder and Co-director Amir D. Aczel Foundation

Scientific committee

Michel Waldschmidt, University of Pierre and Marie Curie, France
Pierre Arnoux, Institute of Mathematics of Luminy, France
Norman J Wildberger, UNSW Sydney, Australia
Marina Ville, François Rabelais University, CNRS, France
Seam Ngonn, Royal University of Phnom Penh, Cambodia
Sok Lin, Royal University of Phnom Penh, Cambodia
Chan Roath, Cambodian Mathematical Society, Cambodia
Kim Chamreounvuthy, MoEYS, Cambodia
Chhit Wornnarith, Royal Academy of Cambodia, Cambodia
Lin Mongkolsery, Institute of Technology of Cambodia, Cambodia
Sim Tepmony, Institute of Technology of Cambodia, Cambodia

Organising committee

Local organising committee.

1. Ly Srouch, Royal University of Phnom Penh, Cambodia
2. Ngov Simrong, Royal University of Phnom Penh, Cambodia
3. Seam Ngonn, Royal University of Phnom Penh, Cambodia
4. Hun Kanal, Royal University of Phnom Penh, Cambodia
5. Sok Lin, Royal University of Phnom Penh, Cambodia
6. Chan Sony, Royal University of Phnom Penh, Cambodia
7. Meas Len, Royal University of Phnom Penh, Cambodia
8. Ham Karim, Royal University of Phnom Penh, Cambodia
9. Mam Mareth, Royal University of Phnom Penh,
10. Ou Pichhang, Royal University of Phnom Penh, Cambodia

International organizing committee.

1. Debra Aczel, Co-founder and Co-director Amir D. Aczel Foundation, USA
2. Miriam Aczel, Co-founder and Co-director Amir D. Aczel Foundation, Imperial College London, England
3. Uk Solang, Switzerland
4. Michel Jambu, University of Nice, France
5. Brigitte Lucquin, University of Pierre and Marie Curie, France

Program

Time	TUESDAY 19 MARCH Morning chair: Marina Ville Afternoon chair: Jean G. Dhombres
8:00-8:30	
8:30-9:00	Registration
9:00-10:20	**Opening Ceremony** H.E. YORK NGOY
9:20-9:50	"K-127" Talk: UK SOLANG
9:50-10:20	Photo Session Coffee break
10:20-11:20	Invited Talk: S.G. DANI
11:20-12:20	Invited Talk: AMIR ALEXANDER
12:20-13:45	LUNCH
13:45-14:45	Invited Talk: NORMAN J WILDBERGER
14:45-15:15	Coffee Break
15:15-16:15	Invited Talk: KIM PLOFKER
16:15-17:15	Invited Talk: BILL CASSELMAN
18:30-	Conference Dinner

Time	WEDNESDAY 20 MARCH Morning chair: Hun Kanal Afternoon chair: Norman J Wildberger
8:00-8:30	Registration
8:30-9:30	Invited Talk: JEAN G. DHOMBRES
9:30-9:40	Award Announcement
9:40-10:00	Coffee Break
10:00-12:00	5 Regular Talks & 2 Contributed Talks Mathematics educations in Cambodia (higher institutions & private sectors)
12:00-13:30	LUNCH
13:30-14:30	Invited Talk: MARINA VILLE
14:30-15:00	Coffee Break
15:00-16:00	Invited Talk: JEAN-FRANÇOIS MAHEUX
16:00-16:50	**Discussion**
16:50-17:00	**Closing ceremony**

Note1: - Invited Talk (50m+ 10m questions)

- " K-127" Talk (20m) + Video showing of "Zero Project" (10m)
- Contributed Talk: (15m+ 3m questions + 2m break)
- Regular Talk: (10m+ 3m questions + 2m break)

Note2: The event in the morning of 19th March will be held in CKCC, and all other lectures will be in room 121 A of Building A; the lunches and the conference dinner will be served. (all in RUPP Campus)

List of topics and abstracts

Topic 1. Why the Numeral Zero on K-127? A Common Man's Point of View
by Dr. Uk Solang, Switzerland.

Abstract: The question on who invented the first numeral zero to be used as a decimal place-holding number still occupies the mind of many historians of mathematics. There is a ZerOrigIndia Foundation based in The Hague that promotes "Come, let us Re-discover Zero. . . ". Indian Math Professor, Dinesh Singh, at Delhi University and a member of the Indian Society for History of Mathematics said:"Finding the source of zero is a bit like finding the source of the Nile." There was also a claim that the zero dot was invented by the Kamrupi civilization in the 2nd/3rd century CE, that once flourished in the area around Golaghat in Assam. The search for the origin of the numeral zero continues. A few tried to claim ownership, but not without contest. The internationally accepted oldest zero in India is the Gwalior zero dated 876 CE. The zero on K-127 is some two centuries earlier than that of Gwalior. The stele is now on public display in the Phnom Penh National Museum since 2017. (Detail of K-127 is found in other pages below)

Topic 2. On Zeroes of Antiquity, Spoken, Written and Inscribed
by Prof. S. G. Dani, Centre for Excellence in Basic Sciences, India.

Abstract: Evolution of the idea of zero presents a fascinating story cutting across several cultures and extending over a long stretch of history. Zero from the early period manifests itself in various forms, spoken, written and inscribed. The aim of this talk will be to trace out some of this history. While the focus will be on what we can glean from the Indian historical sources, including compositions with scientific and literary content as well as relics from everyday life of yore, I will also touch upon zeroes from other cultures, including stele K-127, setting a broader perspective. From India, the Vedic texts, Pingala, the Siddhanta texts of mathematical astronomy, the Bakhshali manuscript, and inscriptions in various contexts, will be some of the sources that will be alluded to. The significance acquired by zero in its march along the course of history is linked intricately with the role it played in calculations along with the decimal place value system, and in systematization of arithmetic, which will also be brought out in the talk.

Topic 3. The Hero and the Foundling: Do Stories Shape Mathematics?
by Prof. Amir Alexander, UCLA, USA

Abstract: From Hippasus of Metapontum, who allegedly drowned at sea as punishment for his discovery of incommensurables, to Kurt Gödel, who reputedly lectured an immigration judge on a logical flaw in the U.S. Constitution, stories have always been the close companions of mathematics and its practitioners. But are they more than amusing anecdotes, told to relieve the pressures of mathematical thinking? To address this question this talk will focus on a selection of mathematical stories that were popular around the turn of the nineteenth century, a time of fundamental restructuring in the field. Different stories, it will become clear, go hand-in-hand with very different conceptions of mathematics. Far from being superficial adornments, stories embody competing ideas on the meaning of mathematics and provide guidance on how it should be practiced.

Topic 4. Old Babylonian mathematics and difficulties with zero
by Prof. Norman J Wildberger, UNSW Sydney, Australia.

Abstract: The history of numerical systems, to the best of current knowledge, begins with the remarkable Sumerian base 60, or sexagesimal system introduced in the third millenium BC. This was then taken up and refined by the Old Babylonian civilization from 1900 BC to 1600 BC. Their arithmetic was powerful and contains lots of surprises for us even today, but an interesting feature was how they dealt with "zero" in their place value system. In this talk we will review some of the main facets of their arithmetic, the kinds of problems they were interested in, and address the intriguing question of how they did their calculations, and some of the consequences of not having an explicit symbol for zero.

Topic 5. Zero and the Historiography of Indian Numeral Systems
by Prof. Kim Plofker, Union College, USA.

Abstract: The scarcity of surviving early archaeological and textual evidence for the Indian decimal place-value system with zero, the ancestor of the conventional numeral system in global use today, has led to many diverse hypotheses about its origins. Tracing the evolution of such hypotheses sheds light on how the history of science has developed and responded to increasing knowledge about the ancient world beyond the limits of classical antiquity. We will examine early instances of transmission involving zero and its "nine companions" and changing historiographic models offered to account for them.

Topic 6. Zeroes in the Bakhshali Manuscript
by Prof. Bill Casselman, University of British Columbia, Canada.

Abstract: The Bakhshali Manuscript has not been dated to everyone's satisfaction, but it is certainly one of the earliest collection of detailed decimal arithmetic. I'll discuss a few of the problems dealt with in it, illustrating the evident role of the written "0" in its calculations.

Topic 7. Fourier with zero, by Prof. Jean G. Dhombres, CNRS, France.

Abstract: Much ado for nothing is certainly the answer too often given about the invention of zero in the Indian world and its slow progression in all kinds of mathematics. Exciting and often remarkable stories have been made and the zero characterizes in a mocking way mathematical activities to the point that in a film a housekeeper in charge of cleaning blackboards in a university recognizes a mathematician by the fact that he always finishes his long series of writing by the double sign = 0. So, taking advantage of this old zero in a tablet at the museum of Phnom Penh, it is useful to see how zero still works in mathematics today. I chose to tell the history of zero in Analysis, and even more particularly in the domain of partial differential equations. Starting from the invention of Fourier series and Fourier integrals in the theory of heat, I am using an unpublished manuscript of this physicist and mathematician where he invented the notion of "eigen modes". Which, in a sense, turns us back to the Cambodian tablet. Indeed, how does a mathematical work pass to posterity? Fourier will only really be recognized worldwide at the end of the 20th century, with the invention of wavelets. In the same way what were the epistemological difficulties for the zero to be spread so slowly but finally everywhere ?

Topic 8. Zero in topology: when we say that a curve, a surface or a space is zero
by Prof. Marina Ville, François Rabelais University, CNRS, France.

Abstract: The early 20th century mathematicians used to say that topology is the geometry of badly drawn figures thus, for a topologist, a football and a rugby ball are the same object. Algebraic topology goes further and encodes spaces with only numbers or algebraic objects; so some spaces are identified as zero. I will sketch how these ideas came about and illustrate by examples why this approach can be useful.

Topic 9. Learning Zero
by Prof. Jean-Francois Maheux, Université du Québec à Montréal, Canada.

Abstract: Zero is a fascinating topic. Very rich in regard to its history, and for what it brings in mathematics, it also leads to interesting observations and questions in mathematics education. Since at least the 1920, people have shown specific concerns regarding the teaching and learning of zero. Nearly an hundred years later, research articles in the field are still published which presents insights and concerns regarding zero. Part of that rests on the fascinating characteristics of zero. In this presentation, I will discuss some of the research around the challenges and opportunities of teaching and learning zero, while highlighting various ways in which issues are raised.

Topic 10. Mathematics in Business with a special emphasis on Actuarial Science
by Ishaan Wadhwa, Senior Manager – Actuarial Prudential Life Assurance PLC.

Abstract: NA

Topic 11. Mathematics and infectious disease research at the Pasteur Institute of Cambodia, by Amber Kunkel, Pasteur Institute of Cambodia.

Abstract: The Institut Pasteur du Cambodge (IPC) is a Cambodian research institute with a particular focus on infectious diseases. Infectious disease research and control relies on mathematics for description, prediction, and hypothesis testing. In this talk, I will discuss the role of geospatial analyses, mathematical modeling, and biostatistics in infectious disease research and control. I will draw particular examples from IPC's work on vector-borne diseases such as malaria, dengue, and Japanese encephalitis.

Topic 12. Mathematics education in Higher educations in Cambodia, by RUPP[1], NIE[2], RAC[3] , ITC[4], and CMS[5]

Abstract: Each institution will present about mathematics education

[1]RUPP: Royal University of Phnom Penh
[2]NIE: National Institute of Education
[3]RAC: Royal Academy of Cambodia
[4]ITC: Institute of Technology of Cambodia
[5]CMS: Cambodian Mathematical Society

List of registered participants

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Kim Plofker, Union College, USA
Debra Aczel, MIT, USA
Miriam Aczel, Imperial College London, England
Dean Gooch, Santa Rosa Junior College, USA
Peter Mark, USA
Amber Kunkel, Pasteur Institute of Cambodia, Cambodia
Ishaan Wadhwa, Prudential (Cambodia) Life Assurance, Cambodia
Path Suykry, KVRT Founder & Chair, Cambodian
Kim Chamreounvuthy, MoEYS, Cambodia
Chan Roath, Cambodian Mathematical Society, Cambodia
Soun Sovann, RUPP, Cambodia
Hak Sokheng, RUPP, Cambodia
Ly Srouch, RUPP, Cambodia
Ngov Simrong, RUPP, Cambodia
Seam Ngonn, RUPP, Cambodia
Chan Sony, RUPP, Cambodia
Meas Len, RUPP, Cambodia
Ham Karim, RUPP, Cambodia
Mam Mareth, RUPP, Cambodia
Lim Sokly, RUPP, Cambodia
Lee Thatsem, RUPP, Cambodia
Heng Pohorn, RUPP, Cambodia
Chan Vithou, RUPP, Cambodia
Ho Serey, RUPP, Cambodia
Chi Kuong, RUPP, Cambodia

Chor Chandara, RUPP, Cambodia
Veng Sothera, RUPP, Cambodia
Srun Sovilla, , RUPP, Cambodia
Ou Pichhang, RUPP, Cambodia
Vong Sotheara, RUPP, Cambodia
Chhit Wornnarith, RAC, Cambodia
Yim Ayuvathnak Vichea, RAC, Cambodia
Kao Muysan, RAC, Cambodia
Leav Pharun, RAC, Cambodia
Mong Mara, RAC, Cambodia
Lin Mongkolsery, ITC, Cambodia
Sim Tepmony, ITC, Cambodia
Khvay Sopheap, ITC, Cambodia
Pen Chentra, ITC, Cambodia
Phok Ponna, ITC, Cambodia
Sim Visoth, NIE, Cambodia
Men Vang, NIE, Cambodia
Phan Sopheap, NIE, Cambodia
Hout Sokloeun, NIE, Cambodia
Duch Dynil, NIPTICT Cambodia
Ek Li, TEC, Cambodia
Sous Sopheap, TEC, Cambodia
Hay Pahen, TEC, Cambodia
Chhum Veasna, TEC, Cambodia
Ol Say, TEC, Cambodia
Katherine Prammer, Cambodian Children's Fund, Cambodia
Margaret Davies, Cambodian Children's Fund, Cambodia
Sum Sotharin, PSE, Cambodia
Im Sopheak, PSE, Cambodia

* A history of this conference

On 18 February, 2016, through Professor Brigitte Lucquin on mission to teach the master course in Mathematics at RUPP, we were contacted by Marina Ville, a French mathematician, and the family of Amir D. Aczel who wish to organise a conference in Cambodia after the death of Dr. Amir D. Aczel (died in November 26, 2015). Dr. Amir D. Aczel is the author of the book " Finding zero". His book has revealed that the earliest zero, was first used in Cambodia, founded in the stele K-127, dated to AD 683, the stone uncovered in 1891 at Sambor on Mekong. The stele K-127 has now been displayed in the national museum in Phnom Penh. This historic discovery of the zero on stele K-127 marks the importance that we host a symposium in Cambodia. (Detail about K-127 is found below)

Today's symposium is dedicated in memory of the late Professor Amir D. Aczel.

*A very brief history of mathematics in Cambodia

It is worth to mention that higher institutions in Cambodia were first established in 1960 and the higher level programs offered only bachelor degree. From 1975 to 1979, Khmer Rouge Regime had forced closure of educations completely. They destroyed the whole education in Cambodia. Restoration had been started since 1979 with the help of foreigner technical advisors and trainers. After they left Cambodia in 1989, higher education in Cambodia, barely reestablished, faced again shortage of qualified teachers, planner educators and expertise. Royal University of Phnom Penh was the main institution to provide bachelor program in Mathematics at that time and was mandated to train large numbers of secondary school teachers to meet the needs of the Government of Cambodia. From year to year, the department grew and there are now twenty one staff and lecturers (only 6 PhD holders). Currently, there are no PhD program in Mathematics at RUPP yet. We are only able to offer master program in mathematics at the national level.

We also have to mention that currently there are only about 10 Cambodian nationals who have been awarded Ph.D degree in mathematics in the whole country. About 5 students are doing Ph.D and some 10 students are doing master abroad. This is due mainly to the results of creation of international master program in mathematics in Cambodia under strong support of CIMPA from 2004 to 2016. Recall that by 2000, only two Cambodian nationals (Dr. Chan Porn and Dr. Chan Roath) were awarded PhD degree in mathematics. In 2003, they requested the help of CIMPA or ICPAM (International Center for Pure and Applied Mathematics) to promote mathematics in Cambodia. CIMPA came and launched the international master program project in mathematics in Cambodia from 2004 to 2016. This project works in collaboration with several international institutes: International Mathematical Union (IMU), French Embassy, Agence Universitaire de la Francophonie (AUF), Unesco, some universities in France, Europe, Japan, Asia, and the USA. We express our appreciation and sincere thanks Dr. Chan Porn and Dr. Chan Roath.

We express our appreciation and sincere thanks especially to professors Michel Jambu, Michel Waldschmidt, Pierre Arnoux, Brigitte Lucquin and all the people involving this CIMPA project.

Thus, Cambodia, as a developing country, is still lacking of human and financial resources in mathematical development and it is highly crucial to promote mathematics for the better contribution to the country's economy.

Therefore, this event will not only promote visibility of Cambodia culture and Cambodia mathematics community to the international but also allow us to have more networks and collaborations with international partners to foster mathematics and mathematics researches in Cambodia.

* Inscription K-127

This symposium co-locates with the official inauguration of the re-installation of K-127 at the National Museum, presided by Her Excellency the Minister of Culture and Fine Arts took place 18th March 2019.

សិលាចារឹក K127 Inscription K127

សិលាចារឹកដែលមានសញ្ញា «លេខសូន្យ» ដំបូងគេ

ត្រពាំងប្រី, សម្បូរណ៌, ខេត្តក្រចេះ

គ.ស 682/83

I.20; D.10; DCA 6836

សជក 311 / ចារឹក K.127

បំណែកមេទ្វារមួយកំណាត់ដែលមានចារឹកជាភាសាខ្មែរសម័យមុនអង្គរចំនួន២១បន្ទាត់នេះ ត្រូវបានរកឃើញដោយលោក អាដេម៉ារ ឡឺក្លែរ ក្នុងឆ្នាំ១៨៩១ ហើយដែលលោក ហង់រី ប៉ាម៉ង់ទីយ៉េ យកមករក្សាទុកនៅសារមន្ទីរខ្មែរនៅឆ្នាំ១៩១២ មុននឹងដាក់តាំងបង្ហាញនៅសារមន្ទីរអាល់ប៊ែរត៍ សារ៉ូត៍ (ឈ្មោះសារមន្ទីរជាតិនាសម័យនោះ) ក្នុងឆ្នាំ១៩២០។ ក្រោយមកទៀត ក្នុងឆ្នាំ១៩៦៩ គេបញ្ជូនសិលាចារឹកនេះទៅរក្សាទុកនៅអគិរក្សដ្ឋានអង្គរ រហូតដល់ឆ្នាំ២០១៥ទើបផ្ទេរមកតាំងបង្ហាញជាថ្មីម្តងទៀតនៅសារមន្ទីរជាតិកម្ពុជា។

លោក ហ៊ិរ្ស សេដែស បានធ្វើការសិក្សា និងប្រែសិលាចារឹកនេះតាំងពីឆ្នាំ១៩៦២មកម្ល៉ះ។ ផ្នែកដំបូងនៃសិលាចារឹកនេះជាបញ្ជីរាយឈ្មោះខ្ញុំបម្រើទាំងឡាយ ហើយដែលខ្លឹមសារពុំពេញលេញដោយសារត្រូវឆៃបបាត់អស់មួយផ្នែក រីឯខ្លឹមសារជាបន្តបន្ទាប់និយាយអំពីតង្វាយដែលលោកម្ចាស់[9] វិទ្យាកែរ្តិ៍ ថ្វាយទៅដល់ទេពព្រះនាម ព្រះគម្ពែងអមរេស្វរ។ តង្វាយទាំងនេះរួមមាន ខ្ញុំបម្រើ សត្វពាហនៈ និងអង្គរ ដើម្បីផ្គត់ផ្គង់ការប្រើប្រាស់ជាប្រចាំនៅប្រាសាទនេះ។ សេចក្តីដែលរៀបរាប់ពីតង្វាយនេះ បញ្ចប់ដោយឃ្លាចុងក្រោយជាពាក្យបណ្តាសាក្នុងគោលបំណងសូមឲ្យថែរក្សាការពារដល់ទ្រព្យដែលជាតង្វាយទាំងនេះ។ ខ្លឹមសារជាបន្ត ក៏ជាការរៀបរាប់អំពីតង្វាយមួយទៀតដែលលោកម្ចាស់ព្រះនាម ឥស្វរិន្ទ ថ្វាយទៅទេពព្រះនាមព្រះគម្ពែងសុវណ្ណលិង្គ និង ព្រះគម្ពែងមណីសិវ ដោយបានបញ្ជាក់យ៉ាងច្បាស់ថាមគ្គផលដែលជាគ្រឿងតង្វាយដល់ទេពទាំងពីរព្រះអង្គនេះ នឹងបានទៅដល់ព្រះគម្ពែងព្រះអមរេស្វរ។

សិលាចារឹកនេះបានទាញការចាប់អារម្មណ៍ពីអ្នកស្រាវជ្រាវ ក៏ដោយសារតែមានកាលបរិច្ឆេទដែលចារនៅបន្ទាត់ទី៤ រំលេចឲ្យឃើញពីគំនូសសញ្ញាតាងឲ្យលេខសូន្យដំបូងគេ។ ដើមឡើយលោក ហ៊ិរ្ស សេដែស បានមើលកាលបរិច្ឆេទនេះថាជាឆ្នាំ៦០៥នៃមហាសកពជ។ ក្រោយមកទៀត លោក លូស៍-ធាល្យ ដាម៉េស៍ បានកែតម្រូវកាលបរិច្ឆេទនេះដោយស្នើថាជាឆ្នាំ៦០៤ នៃមហាសកពជវិញ ដែលត្រូវនឹងរវាងឆ្នាំ៦៨២ ឬ៦៨៣នៃគ្រិស្តសកពជ។ ក្នុងឱកាសនេះដែរ លោក ដាម៉េស ក៏បានបញ្ជាក់ដែរថានៅឆ្នាំដំណាលគ្នានេះ ក៏មានការប្រើគំនូសសញ្ញាតាងឲ្យលេខសូន្យដូចគ្នានេះ ត្រូវបានគេឃើញមានប្រើក្នុងសិលាចារឹកមួយរកឃើញលើកោះសូម៉ាត្រាប្រទេសឥណ្ឌូនេស៊ី។

តាមអ្វីដែលយើងដឹងមកដល់ពេលនេះ ទស្សនៈដែលលើកឡើងពីលេខសូន្យនេះ គឺវាមានចំណាស់ចាស់ជាងនេះ។ ក៏ប៉ុន្តែការលេចឡើងនេះមានសារៈសំខាន់ណាស់ ដ្បិតអីហេតុការណ៍នេះបញ្ជាក់ថាខ្មែរពូកែស្ទាត់ជំនាញផ្នែកគណិតវិទ្យាយ៉ាងធាប់រហ័សដែលមានឥទ្ធិពលពីឥណ្ឌា ជាពិសេសក្នុងការប្រើប្រាស់ទីតាំងលេខ ដែលមានសារសំខាន់ក្នុងការគណនាក្នុងប្រព័ន្ធតារាសាស្ត្រ។

ជាឧទាហរណ៍ រហូតដល់ឆ្នាំ៨២៩គ.ស. ទើបឃើញការលេចឡើងនូវក្បួនគណនារបស់ឥណ្ឌានេះដែលជាស្នាដៃរបស់គណិតវិទូជាតិអារ៉ាប់ លោក មូហាម៉ាត់ អាល់ ខារីស្មី ហើយជាច្រើនសតវត្សក្រោយមកទៀត តាមរយៈការបកប្រែក្បួននេះទៅជាភាសាឡាតាំងបានណែនាំដល់ទ្វីបអឺរ៉ុបឲ្យបានជ្រួតជ្រាបពីគំនិតទស្សនៈនេះ។

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[9] ម្រេតាញ ជាគោរម្យងារនៃមន្ត្រីជាន់ខ្ពស់។

Inscription comprising the first graphic representation of 'zero'

Trapeang Prei, Sambor, Kratie
682-3 A.D.
I.20; D.10; DCA 6836
NMC.311, K. 127

Discovered in 1891 by Adhémard Leclère, this broken doorjamb engraved with 21 lines in Pre-Angkorian Khmer was deposited in the Khmer Museum by Henri Parmentier in 1912 and then exhibited at the Albert Sarraut Museum in 1920. It moved again to the Angkor Conservation Depot in 1969, before being returned to what is now the National Museum of Cambodia in 2015.

The inscription was studied and translated by George Cœdès in 1942. After a first incomplete list of slaves, the text commemorates the donations made to the god *Amareśvara* by a dignitary called *Mratān Vidyākīrti*. These are slaves, livestock and rice to ensure the running of the temple. This act of donation ends with a formula of imprecation intended to protect these goods. This is followed by a second act, reporting this time the donations made by the *Mratān Īçvaravindu* in favor of *Suvarṅaliṅga* and *Maṇiśiva*, and specifying that the revenues of these two gods be shared with those of *Amareśvara*.

This inscription has attracted attention because of the date engraved in the fourth line, which contains the first known graphical representation of 'zero'. First read 605 of the *śaka* era by George Cœdès, this reading of the date was revised by Louis-Charles Damais, who proposed reading 604, which corresponds to 682-83 A.D. On the same occasion, Damais noted that exactly the same date, also using a dot as a graphic representation of zero, is to be found in an inscription from Sumatra.

The concept of 'zero' is, as we know, older, but this occurrence is important because it emphasizes the fact that the Khmers had quickly adopted mathematical ideas from India, in particular, the use of the Positional System, that was essential in the calculation of horoscopes.

Further west, it was not until 825 A.D. that the Indian Calculus appeared, the work of the Arab mathematician Mohammad Al-Khwarizmi, whose translation into Latin allowed the introduction of these notions into Europe several centuries later.

Inscription comportant la première représentation graphique du 'zéro'

Trapeang Prei, Sambor, Kratie
682-3 A. D.
I.20 ; D.10 ; DCA 6836
NMC.311, K. 127

Découvert dès 1891 par Adhémard Leclère, ce piédroit brisé comportant 21 lignes en khmer pré-angkorien est déposé au Musée Khmer par Henri Parmentier en 1912, puis exposé au musée Albert Sarraut en 1920. Il sera a nouveau déplacé au Dépôt de la Conservation d'Angkor en 1969 jusqu'à son retour au Musée National du Cambodge en 2015.

L'inscription a été étudiée et traduite par George Cœdès en 1942. Après une première liste d'esclaves incomplète, le texte commémore les donations effectuées au dieu *Amareśvara* par un dignitaire, le *Mratān Vidyākīrti*. Il s'agit d'esclaves, de bétails et de riz destinés à assurer le fonctionnement du sanctuaire. Cet acte de donation se termine par une formule d'imprécation destinée à protéger ces biens. Il est suivi d'un second acte rapportant cette fois les donations effectuées par le *Mratān Īçvaravindu* en faveur de *Suvarṇaliṅga* et *Maṇiśiva*, et précisant que les revenus de ces deux divinités étaient réunis à ceux d'*Amareśvara*.

Si cette inscription a attiré l'attention des chercheurs, c'est que la date gravée à la quatrième ligne contient la première représentation graphique connue du zéro. D'abord lu 605 de l'ère *śaka* par George Cœdès, la date est révisée par Louis-Charles Damais qui propose la lecture 604, soit 682-83 A. D. ; on notera d'ailleurs qu'à cette occasion, Damais signale la même date dans une inscription de Sumatra.

Le concept du zéro est, on le sait, plus ancien, mais cette occurrence est importante car elle souligne le fait que les khmers maitrisèrent très tôt les mathématiques importés d'Inde et en particulier l'usage de la numération de position, indispensable au calcul d'horoscope.

Il faudra par exemple attendre 825 A.D. pour que paraisse Le Calcul Indien, œuvre du mathématicien arabe Mohammad Al-Khwarizmi dont la traduction en latin allait permettre l'introduction de ces notions en Europe plusieurs siècles plus tard.

About Phnom Penh, Capital City of Cambodia

Once known as the Pearl of Asia, Phnom Penh was considered one of the most beautiful of French-built cities in Indochina in the 1920s. Historically, it first became the royal capital of Cambodia in 1432 under King Ponhea Yat era. Due to internal conflict between the royal pretenders, this city was abandoned from 1505 until 1865. However, under the reign of King Norodom I, it has become the permanent seat of government and capital of Cambodia. Being under the French Colony, Phnom Penh was modernized from a riverside village into a city where the hotels, schools, banks, public works offices, telegraph offices, law courts, and health services buildings were built.

Since then, Phnom Penh is the capital and largest city of Cambodia which is located at the bank of the Tonle Sap river, Mekong river, and Bassac river. With over 1.5 million people (2012) of Cambodia's population on the area 678.46 sq.km, Phnom Penh has grown to become the industrial, commercial, cultural, tourist, politic, historical, and educational center.

Riverside, Phnom Penh

National politics in Cambodia take place within the framework of the nation's constitution of 1993. Operated as a parliamentary representative democracy, Phnom Penh is the main political center which is containing main institutes – the councils of ministers, the national assembly, the parliament, Supreme Court and so on. Tourism is also a major contributor in the capital as more shopping and commercial centers are open. This makes Phnom Penh becoming one of the major tourist destinations in the country which regards to around 950,000 people per year. The main tourist places in Phnom Penh are royal palace, national museum, wat phnom, independent monument, central market, river front, toul tom poung market, toul sleng genocide museum, and choeung ek memorial.

Royal Palace

Royal Palace, which was built in 1866 under King Norodom era, is now home to His Majesty King Norodom Sihamoni, and the elder Queen of Cambodia.

Royal Palace

Situated at the Western bank of the four divisions at the Mekong River, the Royal Palace faces towards the East. Covering an area of 174,870 sq.m (402m x 435m), it is constructed with much classic Khmer architecture such as the defensive wall, the throne hall, Temple of the Emerald Buddha, stupas, towering spires and mural paintings. Moreover, the French-built building, Napoleon III Pavilion known as the Silver Pagoda, was built on the north side of the palace. The palace grounds are opened to the public when the King is not in residence.

National Museum

National museum is unique and the finest of Phnom Penh's architectures, known as the Red House. It is Cambodia's largest museum of cultural history and the country's archaeological museum. Located at the north of the Royal Palace, the museum has recently been stored more than 5,000 works of art, ranging from the 7th to the 13th century, which is including sculpture, 19th century dance costumes, royal barges and palanquins. Exploring and contemplating one of Asia's riches cultures, tourists can rest by the peaceful at the palm-shaded central courtyard with the lotus ponds.

National Museum

Wat Phnom

Wat Phnom known as the legendary founding place of Phnom Penh is a small hill crowned by an active wat (temple). The current temple was last rebuilt in 1926 and received a facelift in 1998. Legend has said that after a particularly heavy flood, a wealthy woman named Daun Penh found a tree on the banks of the Mekong with four statues of Buddha hidden inside. Then, she built a temple in 1434 to house the sacred relics. With the strong belief from overall Cambodia's citizen, Wat Phnom is one of the most visit places for tour and religion.

Wat Phnom

River Front

The bank of the four divisions at the Mekong River, locating in front of the Royal Palace, is constructed as the River Front. A long from the Japan-Cambodia cooperation bridge (Chroy Chang Va bridge) till Hun Sen public park, the River Front is decorated with colorful-flower garden which is attracted to many visitors both local and international tourists. Besides being as a river bank covered with a nice garden, it is also a home to many international style bars and restaurants that are now located in restored 19th century colonial villas. Moreover, most of the city's major festivals are holding over there including Khmer New Year (in April) and Water Festival (in November).

Independence Monument (Vimean Ekareach)

Independence monument was built in the form of a lotus-shaped stupa of the style seen at the great Khmer temple—Angkor Wat and other Khmer historical sites—in 1958. It represents our independence and peace from French colony. During national celebrations, the Independence Monument serves on political holidays such as the January 7, Constitution Day (September 24), and Independence Day (November 9).

Independence Monument

Central Market (Psah Thmei)

The central market, called Psah Thmei in Khmer, is housed in a French colonial-style building in the heart of Phnom Penh. It was built in 1937 in Art Deco style and is painted bright orchre which consists of four wings dominated by a central dome. The four wings and around the compound outside sell almost everything you can think of including clothing, jewelers, dried and fresh food stuff, electronic equipment, pseudo-antique, stationeries, travel guides, souvenirs, and especially clothes from cheap T-shirts to krama (Khmer scarves).

Russian Market (Psah Toul Tom Poung)

Psah Toul Tom Poung has become the foreigner's market during the 1980's when most of the foreigners in Cambodia were Russians, hence it's named 'Russian Market'. Alternating with an attractive of its building, Psah Toul Tom Poung is attractive to many foreigners in more varied selection of souvenirs, curios and silks. Moreover, it is known as one of the best markets in the city to buy fabric.

Toul Sleng Genocide Museum (S-21)

Toul Sleng Genocide Museum, a former high school, was used as the notorious Security Prison 21 (S-21) by the Khmer Rouge communist regime from its rise to power in 1975 to its fall in 1979. Overall of the school buildings now serve as a museum and evidence of the regime. Photos of some victims, paintings by a survivor hang on the walls, as well as the stamp of blood, the bed, the handcuff, and chains are still remanding there.

Choeung Ek memorial (The killing fields)

Choeung Ek memorial, the killing fields, was the site of the brutal executions of more than 17,000 men, women, and children. Most of them had first suffered through interrogation, torture and deprivation in the S-21 Prison (now the Toul Sleng Genocide Museum) during the Khmer Rouge regime. It contains of mass graves, killing areas and a memorial stupa storing thousands of human skulls and long bones.

Detailed program

TUESDAY, 19 MARCH- with details		
TIME	**PROGRAM**	**PIC**
8:00-9:00	Registration	Committee
9:00-9:50	**OPENING CEREMONY**	
9:00-9:05	Cambodian Anthem "Nokor Reach"	Committee
9:05-9:10	Remarks by Vice-Rector of RUPP	Mr. Chhun Hok
9:10-9:15	Remarks by Co-chairs, Co-Founder and Co-Director of Amir Aczel Foundation	Dr. Debra G. Aczel, and Miriam R. Aczel
9:15-9:20	Opening Remarks by Secretary of State, Ministry of Education, Youth and Sport	H.E. York Ngoy
9:20-9:50	Why the Numeral Zero on K-127? A Common Man's Point of View	Dr. Uk Solang
9:50-10:20	Photo session & Coffee break	Committee/MC
10:20-11:20	On Zeroes of Antiquity, Spoken, Written and Inscribed	Prof. S. G. Dani
11:20-12:20	The Hero and the Foundling: Do Stories Shape Mathematics?	Prof. Amir Alexander
12:20-13:45	LUNCH	Committee
13:45-14:45	Old Babylonian mathematics and difficulties with zero	Prof. Norman J Wildberger
14:45-15:15	Coffee Break	Committee
15:15-16:15	Zero and the Historiography of Indian Numeral Systems	Prof. Kim Plofker
16:15-17:15	Zeroes in the Bakhshali Manuscript	Prof. Bill Casselman
18:30-	CONFERENCE DINNER	Committee

WEDNESDAY, 20 MARCH- with details		
TIME	**PROGRAM**	**PIC**
8:00-8:30	Registration	Committee
8:30-9:30	Fourier with zero	Prof. Jean G. Dhombres
9:30-9:40	Award Announcement	Committee
9:40-10:00	Coffee break	Committee
10:00-12:00	Mathematics educations at higher institutions and in private sectors in Cambodia	RAC, RUPP, ITC and NIE Pasteur Institute of Cambodia Prudential Life Assurance PLC
12:00-13:30	LUNCH	Committee
13:30-14:30	Zero in topology: when we say that a curve, a surface or a space is zero.	Prof. Marina Ville
14:30-15:00	Coffee Break	Committee
15:00-16:00	Learning Zero	Prof. Jean-Francois Maheux
16:00-16:50	DISCUSSION	all
16:50-17:00	CLOSING CEREMONY	Committee

Have a pleasant stay in Cambodia!

Angkor Wat Temple, Siem Reap!