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# REPORT ON PERSONAL PALAEOGRAPHY INITIATIVES, QIN-HAN CHINA (221 BCE–220 CE)

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Primarily a historian of astronomy and mathematics in early imperial China ( $\approx$  221 BCE–750 CE), at the CNRS [Laboratoire SPHere](#) (Sciences – Philosophie – Histoire, UMR 7219) since 2013, I was trained in palaeography and manuscript studies at the University of Chicago, 2006–2013, and in close collaboration with Wuhan University’s [Center for Bamboo and Silk Manuscripts](#). My primary goal vis-à-vis Chinese palaeography since 2013 has been to build bridges: namely, to insert manuscript studies into the study of mathematical manuscripts and, vice versa, to insert mathematical manuscripts into manuscript studies by providing concrete examples of what we stand to learn from one another across the history of science divide.

This report will proceed chronologically and thematically through my past, present, and future projects, with embedded html links directing the reader to all available resources.

## 1. Orality and visual copying

In my masters’ thesis of 2009, I performed a codicological analysis of the duplicate Warring States (475–221 BCE) manuscripts *Tianzi jianzhou* 天子建州 (The Son of Heaven Builds his Realm) A and B from the Shanghai Museum collection, the primary results of which were to highlight evidence of reverse-impression ink transfer and signs of visual copying from manuscript B to manuscript A.

My observations about reverse impressions I published as a research note in 2007 ([here](#)) and have since dropped due my work having been surpassed by [Thies Staack](#)<sup>1</sup> and the lack of verso photos of the manuscripts I have been studying since.

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<sup>1</sup> Staack Thies, ‘Yuelu Qin jian Wei yu deng zhuang si zhong juance yi de bianlian: yiju jianbei huaxian he jianbei fanyin ziji fuyuan juanzhou yuanmao’ 嶽麓秦簡『爲獄等狀四種』卷冊一的編聯——依據簡背劃線和簡背反印字跡復原卷

Beat to publishing on the *Tianzi jianzhou* manuscripts by [Matthias Richter](#) in 2009,<sup>2</sup> I turned my attention to what this and three additional sets of duplicate manuscripts from the same find might tell us about the role of visual copying in textual transmission versus [Martin Kern](#)'s famous case for traces of memorisation, dictation, and oral transmission in Warring States manuscripts.<sup>3</sup> Revealing that all four sets of duplicate manuscripts show clear evidence of visual copying and none of the stylistic, structural, phonetic, or lexical variability claimed rampant by Kern, I extended the statistical basis of his original studies, insisting that we think of *variora* between scripts in the lens of 'translation', and showed that versions of several texts *across tombs* in Warring States Chu script reveal a similar level of orthographic consistency as the same-tomb duplicates. That said, outside of a single tomb, evidence for visual copying between manuscripts disappears, leading me to conclude that we will probably never have a solid answer to his question.

I presented this work at a workshop of 2010 ([here](#)) and a conference of 2011 ([here](#)), but have since dropped this specific project as I have moved away from the period in question. Rather, I have begun exploring the matter of orality and manuscript transmission in Qin-Han calendars and mathematical manuscripts.

## 2. The \**Wuxing zhan* planetary tables, silk, TAQ 168 BCE

My present researches in Qin-Han manuscript studies go back to my work on the silk manuscript \**Wuxing zhan* 五星占 (Planetary Omens)<sup>4</sup> excavated in 1973 from Mawangdui tomb 3, sealed 168 BCE, which comprises omen formulae, planetary models, and calculated visibility tables for the five naked-eye planets.

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軸原貌, trans. Li Jingrong 李婧嶸, *Hunan daxue xuebao (zhehui kexue ban)* 湖南大學學報 (社會科學版) 27, no. 3 (2013): 20–25.

<sup>2</sup> Matthias Richter, 'Faithful Transmission or Creative Change: Tracing Modes of Manuscript Production from the Material Evidence', *Asiatische Studien/Études Asiatiques* LXXIII, no. 4 (2009): 889–908.

<sup>3</sup> Martin Kern, 'Methodological Reflections on the Analysis of Textual Variants and the Modes of Manuscript Production in Early China', *Journal of East Asian Archaeology* 4, no. 1–4 (2002): 143–81; Martin Kern, 'The *Odes* in Excavated Manuscripts', in *Text and Ritual in Early China*, ed. Martin Kern (Seattle: University of Washington Press, 2005), 149–93.

<sup>4</sup> Asterisks (\*) indicate titles given to untitled manuscripts by their initial editors.

I began a rough study of the manuscript's contents in 2008 ([here](#)), and soon became interested in how the nature of technical literature allows one to unequivocally identify errors and their cause: e.g., '2 + 5 = 10' is simply wrong, and we know from the graphic similarity of \**ts<sup>h</sup>it* 七 '7' and \**dzip* 十 '10' that this error necessarily results from visual copying rather than mishearing or miscalculating. I developed on this in a talk of 2010 ([here](#)), 2011 ([here](#)), and 2012 ([here](#)), leading to a brief discussion in two larger articles on the manuscript in 2011 ([here](#)) and 2016 ([here](#)).

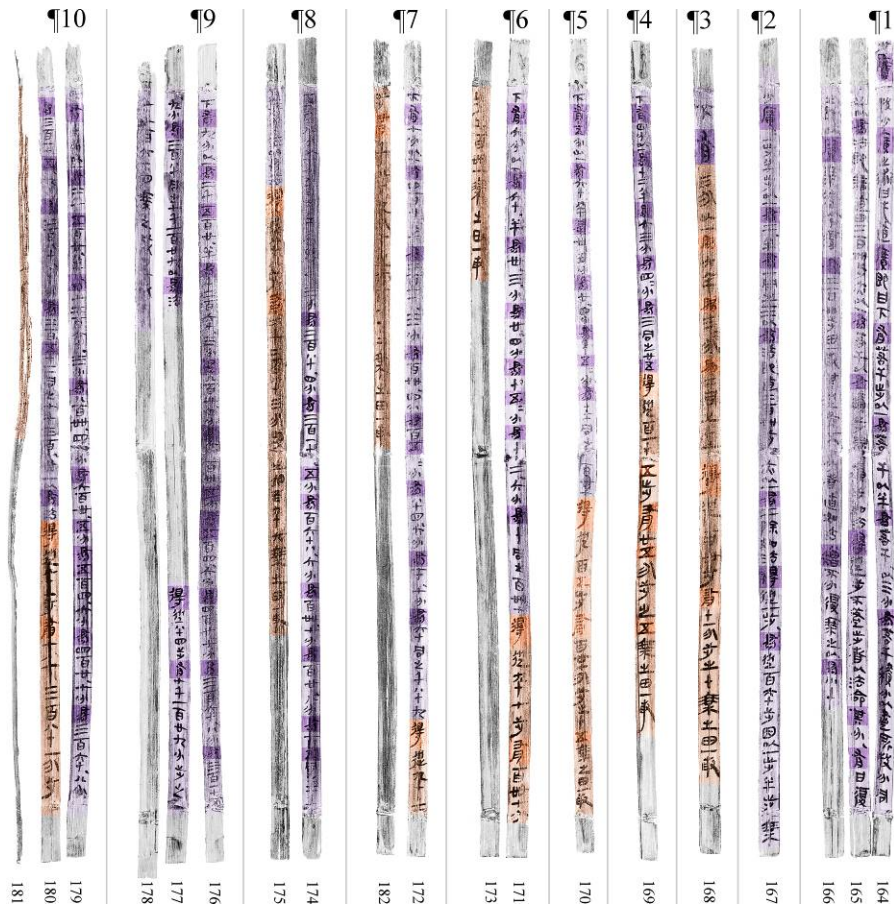
Coming back to the topic of orality in the context of a workshop on that subject in 2014 ([here](#)), I brought in examples of the sort of rampant errors that plague technical manuscripts in astronomy, mathematics, and calendar divination to offer an explanation as to why, in Han (206 BCE–220 CE) and Three Kingdom (220–280 CE) sources, mathematical astronomy tends to be learned exclusively via face-to-face transmission and why astronomers are so dismissive about the authority of written text. Technical literature, I underline in the resulting article of 2015 ([here](#)), is as crucial to any discussion about orality as the poetry and philosophical texts favoured exclusively by studies like Kern's.

### 3. The *Suan shu shu*, bamboo, TAQ 186 BCE

Excavated in the winter of 1983–1984 from Zhangjiashan tomb 247 (sealed  $\geq$  186 BCE), the bamboo manuscript *Suan shu shu* 算數書 (*Math Book*) was the earliest of its kind ever recovered and, codicologically, a rather peculiar tomb manuscript. First, the bottom margin features conspicuous dots and the 'signatures' of two individuals – Yang 楊 and Wang 王 – noting that they have 'already checked' 已讎 its contents. Second, the 69 'line-break'-marked sections comprising its contents bear titles in the upper margin, which, looking back from the three other such manuscripts that have been (or are current in the process of being) published since, is completely unique. Third, the 69 sections are both textually and codicologically independent, and no one can agree on their original order.

Inspired by the question 'If it's been checked, why are there still mistakes?', [Karine Chemla](#) and I began working together on the *Suan shu shu* in 2014 to try to resolve this and other lingering questions about the manuscript's composition.

In the first stage of our collaboration, we began with a basic codicological analysis of the manuscript, including an attempt to discern



**Fig. 1** *Suan shu shu* ‘Shao guang’ 少廣 question–answer alternation between SSS(B), in purple, and SSS(A), in orange.

different hands (particularly those of the titles and ‘signatures’ vs the body). We did not know what we were doing; progress was slow, and we made a lot of mistakes, but we came to the gradual realisation that there are indeed *two hands*, and that they are *alternating* in a pattern suggestive of a teacher and a student (see fig. 1), which completely changes our reading of the text. We presented our initial findings in two separate talks in 2014 ([here](#) and [here](#)), the latter of which was published as an article in 2016 ([here](#)).

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In order to build bridges, I organised an international workshop around the Zhangjiashan tomb 247 manuscript corpus at Université

Paris Diderot on 25 November 2015 with Karine and [Alain Thote](#) and [Olivier Venture](#) of the EPHE and [CRCAO](#) (see conference website [here](#)). The idea was for me to attempt a corpus-wide handwriting analysis to see what codicological ties there might be between the *Suan shu shu* and the other manuscripts, on administration, law, medicine, exercise, and military philosophy, etc., to spark an interdisciplinary discussion of common stakes. My attempt at moving from the *differentiation* to the *identification of hands* ([here](#)) was not particularly successful, but the workshop was, and I received the constructive criticism and suggested reading necessary to improve my attempt and intra-corpus handwriting identification.

The problem, when I began in 2014, was that there was no real methodological consensus about how to go about handwriting analysis in early Chinese manuscripts. Mostly, one relied on the impressionistic declarations of older gentlemen accomplished in calligraphy, and the experiments of younger scholars with a more quantitative approach tended to be one-off theoretical ventures.<sup>5</sup> This changed in 2015, with the publication of [Li Songru](#)'s 李松儒 long awaited monograph<sup>6</sup> – a methodological study by a young woman trained both by a museum in ancient calligraphy and, by the Public Security Bureau, in modern forensic graphology. Needless to say, for those who know Li Songru, I had to throw out most of what I thought I knew about the subject one or two chapters in.

All the same, Li's work is focused on pre-Qin scripts, and it does not lay out the sort of 'point and shoot' methodology for which I was hoping, so when invited to Heidelberg to talk graphology in 2016, I set about tweaking Li's apparent method to my own purposes vis-à-vis Zhangjiashan tomb 247 ([here](#)). At best, mine is a departure from her methodology, and, at worst, a misunderstanding, so I decided to give it its own name: 'fingerprinting'.

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<sup>5</sup> For example, Matthias L. Richter, 'Tentative Criteria for Discerning Individual Hands in the Guodian Manuscripts', in *Rethinking Confucianism: Selected Papers from the Third International Conference on Excavated Chinese Manuscripts, Mount Holyoke College, April 2004*, ed. Xing Wen 邢文 (San Antonio: Trinity University, 2006), 132–47; Nishiyama Hisashi 西山尚志, 'Kakuten sokan *Gosō shino shōsha ni tsuite: Jiketeki barieeshon no tōkeigakuteki kōsatsu*' 郭店楚簡『語叢四』の抄者について：字形的バリエーションの統計學的考察, *Shogaku shodōshi kenkyū* 書學書道史研究 17 (2007): 80–xx.

<sup>6</sup> Li Songru 李松儒, *Zhanguo jianbo ziji yanjiu: yi Shangbo jian wei zhongxin* 戰國簡帛字跡研究：以上博簡為中心 (Shanghai: Shanghai guji chubanshe, 2015).

	A	B	
又			a
為			b
實			c
廣			d
左右比例			e
字尾			f

**Fig. 2** *Suan shu shu* A–B ‘fingerprint’ chains. Criteria: (a) 又 component, angle, square vs. round; (b) 為; (c) 實, final stroke and composition (卣 vs. 尹); (d) 廣, “feet” and component symmetry; (e) 木·禾 left–right component symmetry; (f) exaggerated end-stroke.

better yet, said script, one can calculate the odds of *concurrency* down to impossible levels.

In Zhangjiashan tomb 247, for example, *Suan shu shu* B and *Gailu* 蓋廬 both feature a 其 whose upper component is pinched to the left (其 : 其), which is the case for 3/10 samples. Both consistently use the same form for 為 (為 : 為), which is the case for 4/11. Both use the same 而 (而 : 而), as do, let’s say, 3/11. Both imperfectly cross their 5s (𠄎 : 𠄎), as do 5/9. Both write 實 from 尹 (vs

In short, fingerprinting relies on building chains of ‘characteristic traits’ 字迹特徵 that are (1) consistent within a given writing sample and (2) consistently different with others under consideration. One first scours an individual text for appropriate candidates, as in fig. 2, then colour codes, in this case, each appearance of form A and B of characteristic *a*; then, as form A of *a* appears consistently on the same slip with, for example, form A of *b*, one extends the colour coding to the second characteristic, then, from there, to the third, fourth, fifth, and so on, until the entire manuscript is colour coded and the point(s) of transition between fingerprints stands out.

Once one has done this to the entire corpus, one then assembles the text-specific fingerprints into a single table, fills out the missing cells as much as possible, and moves the columns back and forth until patterns of similarity and dissimilarity emerge (see fig. 3). This work is subjective and impressionistic, but it is amenable to quantification: namely, if one is able to determine the rate at which a given characteristic occurs within said corpus or,





卅), as do 8/9. Just from this we can say that the odds of all these features coinciding in two independent samples in this corpus are something like 1440:89010 (1%).

In the end, however, the only proof that matters is experience, so ‘fingerprinting’ appeals to experience via two strategies: first, by reproducing the discernments of older gentlemen accomplished in calligraphy via different means, and, second, by producing a conversion experience in the reader using images and skilfully designed questionnaires.

A summary of this method and the results of my corpus-wide analysis of the Zhangjiashan tomb 247 manuscripts have been published in the updated, English-language version of our article this year ([here](#)). In addition, I have quietly run a complete analysis of two other tombs – Zhoujiatai tomb 30 and Kongjiapo tomb 8 – begun the Yuelu Academy collection, and plan to run a full analysis on Shuihudi tomb 11 and Mawangdui tomb 3 once I get PDFs required. The method is extremely fast, and I should be able to map the hands of a corpus like Mawangdui in little more than two weeks.

The goal of this personal initiative is sharing and equipping colleagues and students with an easy method for doing what is usually described as impossible for someone who is not Chinese and not practiced calligraphy for forty years. To this end, I have made my original 2017 talk publically available [here](#), I have recently presented an updated Chinese-language version soon to be available [here](#), and I will be sharing my colour-coded PDFs via personal communication to anyone who is interested.

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In May of 2014, Karine and I were invited to publish a second study on the *Suan shu shu* in the journal of Universität Hamburg’s [Centre for the Study of Manuscript Cultures](#), this one on the use of punctuation and/as correction. We are stalled and now more than four years behind, but we did present some preliminary findings at the ICHST in 2017 ([here](#)).

Lastly, last month in Wuhan I met with Tan Jingnan 譚競男 of Jiangnan University, a young scholar working on the comparative study of the growing corpus of mathematical manuscripts, and we have discussed future collaboration concerning, among other things, manuscript transmission in mathematics and divination literature.

I am also working on a surprise for Enno Giele that I am keeping secret :^P

## 4. Calendars

Calendars are one of the most common types of text excavated from Qin-Han tombs and administrative dump sites, and in as much as calendars are products of *li* 曆 mathematical astronomy, I have had a keen interest in their production, copying, dissemination, standardisation, corruption, and use since my dissertation of 2013, about which you can read in chapter 3 of my 2017 monograph ([here](#)).

In short, it was the sage king's classically-decreed duty to 'observe the signs of heaven and grant the seasons of man', but nowhere do the Classics or later received sources go into much detail about the actual logistics of supplying an empire with a new calendar every year, so I attempt to reconstruct them from the bottom up, covering lowly realia and lofty rhetoric, ancient ideals and contemporary practice, the calendar as it exists for politicians, philosophers, astronomers, copyists, postmen, and daily users. As concerns manuscript studies, this involves the cataloguing, categorisation, and study of the corpus; the analysis of first-hand errors and second-hand accounts for clues about copying and dissemination practices; and a look at how different people used, thought about, and manipulated these material manifestations of public time in personal ways.

My interest in this topic has brought me into collaboration with [Alain Arrault](#) and the various projects that he is leading on this subject. Namely, I have developed on individual findings reported in the monograph at workshop and conference talks in his series *Calendriers d'Europe et d'Asie* in 2016 ([here](#)) and 2017 ([here](#)) and am currently preparing a contribution to a collective volume coming out of the final conference that will take my 2017 chapter further. In addition, we are nominally working together on a database of excavated Chinese calendars, but work there has yet to begin.

In addition, for the sake of building bridges, in my work on corpus-based handwriting analysis, I made a gambit about the importance of calendars to the other manuscripts with which they are found in my 2015 talk ([here](#)):

Note-carrying calendars tend to be the most personal text in any tomb corpus. They are universally accepted as being *written about* the tomb occupant for purposes of determining his identity and date of interment, and the way that most scholars write about them assumes that they are likewise *written by* the self-same person. *If this is true*, then we have the tomb occupant's handwriting, and we can determine what else of his funerary library he personally copied or

wrote and how and how many people he interacted with in doing so. *If this is true*, furthermore, we can also dismiss the possibility that these texts are *mingqi* 明器 ‘funerary fakes’ with no bearing on the occupant, his time, or contemporary written culture.

This, in 2015, was offered on a premonition of what I thought I might find by digging deeper into sources beyond Zhangjiashan tomb 247. Three years later I am now considerably closer to moving us away from the hypothetical in the previous statement and towards an unexpected direction. God willing, I will have more to say about this in 2019.

Lastly, in the spirit of more bridges, I note that many early China scholars use a distinction like Martin Kern’s between a ‘text with a transmission history’, like the *Book of Odes*, versus ‘texts... confined to a single geographically, chronologically, and functionally specific purpose – an inventory slip, an administrative order, a divination record, and so on’<sup>7</sup> to eliminate administrative documents from consideration as concerns questions of orality, textual transmission, etc. I would like to use calendars to collapse this divide and forcefully insert *administrative documents* alongside math and divination into any discussion of the matter that would limit itself to poetry and philosophy. The key is that calendars are all of the above: they are *occasional* (one-year) *administrative documents* of a *technical nature* that, due to their necessity and lifespan, are *transmitted further, in greater numbers, and more regularly* than perhaps any other type of text. As such, I would like to carry out some sort of comparative study of apparent copying and transmission practices with calendars at the centre to demonstrate their utility to questions raised in different areas of manuscript studies.

## 5. Conclusion

That is what I have been up to in manuscript studies. I hope that you will be so kind as to keep helping me do it better with your questions, advice, outside examples, and constructive criticism.

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<sup>7</sup> Kern, ‘Methodological Reflections’, 145.

## Publications

- (w/ Karine Chemla). ‘Math lessons: towards an interdisciplinary approach’ (tentative title), *Manuscript Cultures*. (in preparation)
- ‘Les derniers jours du défunt : l’Empire et l’individu vus des calendriers récemment excavés des tombes du début de la Chine impériale’. *Calendriers d’Europe et d’Asie*, ed. Alain Arrault, Olivier Guyotjeannin and Perrine Mane. (in preparation)
2018. (w/ Karine Chemla) ‘Writing in turns: an analysis of scribal hands in the bamboo manuscript *Suan shu shu* 算數書 (*Writings on Mathematical Procedures*) from Zhangjiashan tomb no. 247’, *Bamboo and Silk* 1: 152–190. [[Brill Online](#)]
2017. *Astral Sciences in Early Imperial China: Observation, Sagehood and the Individual*, Cambridge University Press. [[Cambridge Core](#)]
2016. ‘The planetary visibility tables in the second-century BC manuscript *Wu xing zhan* 五星占’, *East Asian Science, Technology, and Medicine* 43: 17–60. [[JSTOR](#)]
2016. (w/ Karine Chemla). ‘Ye you lunzhe xiede: Zhangjiashan Han jian *Suan shu shu* xieshou yu pianxu chutan’ 也有輪著寫的：張家山漢簡《算數書》寫手與篇序初探, *Jianbo* 簡帛 12: 235–251. [[halshs-01347036](#)]
2015. ‘What good’s a text? Textuality, orality, and mathematical astronomy in early imperial China’, *Archives internationales d’histoire des sciences* 65.2: 549–572. [[Brepolis Online](#)]
2011. ‘Cong Zhoujiatai *Rishu* yu Mawangdui *Wuxing zhan* tan rishu yu Qin Han tianwenxue de huxiang yingxiang’ 從周家臺『日書』與馬王堆『五星占』談日書與秦漢天文學的互相影響, *Jianbo* 簡帛 6: 113–137. [[halshs-01333543](#)]
2007. ‘*Tianzi jianzhou* zhong suojian fanyinwen, weishizy ji jidian yiduan’ 『天子建州』中所見反印文、未釋字及幾點臆斷, *Bamboo and Silk Manuscripts* ([http://www.bsm.org.cn/show\\_article.php?id=764](http://www.bsm.org.cn/show_article.php?id=764)).

## Talks

- 2018.05.14. ‘Rili zai Qin Han muzang wenxian jiti ziji fenxi zhong de qianneng’ 日曆在秦漢墓葬文獻集體字跡分析中的潛能. Invited talk, Wuhan University. [[halshs-01780068](#)]
- 2017.10.05. ‘Les derniers jours du défunt : l’Empire et l’individu vus des calendriers récemment excavés des tombes du début de la Chine impériale’. *Calendriers d’Europe et d’Asie*, Institut national des chartes. [[halshs-01497257](#)]
- 2017.07.23. (w/ Karine Chemla). ‘Should headings of sections in *Writings on mathematics* 算數書 (before ca. 186 BCE) be interpreted as a curriculum?’ *25th International Congress of History of Science and Technology*, Rio de Janeiro. [[halshs-01406453](#)]
- 2016.11.16. ‘On the potential of corpus-based handwriting analysis: a refined analysis of the Zhangjiashan tomb library’. *Scribal Hands and Scribal*

- Practices in Manuscripts from Warring States and Early Imperial China*, Universität Heidelberg. [[halshs-01368873](#)]
- 2016.10.06. ‘Sur lattes de bambou et planchettes de bois : les premiers calendriers annuels en Chine (III<sup>e</sup> siècle avant notre ère – II<sup>e</sup> siècle après notre ère), leurs usages et fonctions’. Atelier *Calendriers d’Europe et d’Asie : supports, usages et fonctions*, EFEO, Paris.
- 2015.11.25. ‘What can you do with a Calendar? Extracting Facts, Stories, and Information otherwise pertinent to your own Field from a Table of Dates’. *Workshop on Zhangjiashan Tomb 247*, Paris 7. [[halshs-01333719](#)]
- 2014.10.26. (w/ Karine Chemla). ‘Ye you lunzhe xiede: Zhangjiashan Han jian *Suan shu shu xieshou yu pianxu chutan* 也有輪著寫的：張家山漢簡《算數書》寫手與篇序初探. *International Forum for the Study of Chinese Excavated Texts 2014*, University of Chicago. [[halshs-01333734](#)]
- 2014.06.12. ‘What Good’s a Text? Textuality, Orality, and Mathematical Astronomy in Early Imperial China’. Seminar *History of Science, History of Text*, Paris 7. [[halshs-01341847](#)]
- 2014.05.08. (w/ Karine Chemla). ‘Math Lessons: Towards an Interdisciplinary Approach to an Early Chinese Manuscript Culture’. *What Can the History of Science Contribute to Manuscript Studies or What Can Manuscript Studies Contribute to the History of Science?* Centre for the Study of Manuscript Cultures, Universität Hamburg. [[halshs-01333739](#)]
- 2012.03.23. ‘The Planetary Visibility Tables in the Second Century B.C. Manuscript *Wuxing zhan*’. Seminar *History of Science, History of Text*, Paris 7. [[hal-01341891](#)]
- 2011.10.15. ‘A Positive Case for the Visuality of Text in Warring States Manuscript Culture’. *The Rise of Writing in Early China*, University of Chicago. [[halshs-01341905](#)]
- 2011.03.12 ‘Muddled Math and its Implications for early Chinese Manuscript Culture’. *221st Meeting of the American Oriental Society*, Chicago. [[hal-01333669](#)]
- 2010.12.08. ‘Cong Zhoujiatai *Rishu* yu Mawangdui *Wuxing zhan* tan rishu yu Qin Han tianwenxue de huxiang yingxiang’ 從周家臺《日書》與馬王堆《五星占》談日書與秦漢天文學的互相影響. *2010 International Forum for Chinese Bamboo and Silk Manuscript Studies*, Wuhan University. [[halshs-01341917](#)]
- 2010.04.24. ‘A Positive Case for the Visuality of Text in Warring States Manuscript Culture’. *Creel-Luce Paleography Forum*, University of Chicago. [[halshs-01333472](#)]
- 2008.10.09. ‘The Planetary Model and Visibility Table for Venus in the –2nd Century Silk Manuscript *Wu xing zhan* 五星占’, China Before Print Workshop, University of Chicago. [[halshs-01341928](#)]