
1001 Inventions: The Enduring Legacy of Muslim Civilization edited by
Salim T. S. al-Hassani

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1001 Inventions: The Enduring Legacy of Muslim Civilization is the companion book to the exhibition ‘1001 Inventions: Discover the Golden Age of Muslim Civilization’ that ran from 3 August 2012 to 3 February 2013 under the auspices of the National Geographic Society, Washington DC, in cooperation with the Foundation for Science, Technology and Civilisation (FTSC), Manchester. The difference in title between exhibition and book is significant and substantial. The exhibition claimed to focus on the long gone past. The book insists explicitly on the relevance of this past to today, in particular, to today’s sciences and technologies.

This third edition of *1001 Inventions* has undergone a visible effort of moderation, alteration, and adaptation. I cannot judge, of course, whether this is also the case for the spirit of the exhibition, which its director, Prof. em. Salim al-Hassani, claimed is identical with the previous ones. The changes in the book concern aspects of political correctness, religious expressions, and various errors, great and small, of content and language. ‘Mankind’, for instance, has been changed to ‘humankind’. The constant repetition of ‘pubh’ (‘peace be upon him’) has been almost completely abolished. Claims such as ‘the universal nature of Islam’ were deleted. al-Kindi no longer appears as the head of a team appointed by Caliph al-Maʿmun for translating Aristotle’s works. The often faulty English of the second edition has been improved somewhat, though there still remain phrases and sentence that are unidiomatic in English. The Arabic has not been not corrected and continues to suffer from numerous mistakes and different styles of transliteration, some of them apparently of South Asian origin, others derived from academic usage. So many gross errors have slipped through the nets of the two editorial teams of the National Geographic Society and the FTSC that I wonder

whether this was due to careless browsing, lack of historical knowledge, or incompetence in mathematics, the sciences, or the arts. Several central messages of the earlier companion books have been omitted, as I will outline below. In their place, new messages of *cross-cultural respect* and the search for ‘the cultural roots of science’ have been introduced. al-Hassani, the Chief Editor of the book, now delivers speeches laden with these two catchphrases, the historiographical meaning of one of which, namely, ‘cultural roots of science’, he does not understand at all as the book leaves no doubt.

All in all, the fundamental distortion of history embedded in the thesis that today’s sciences and technologies depend on inventions and discoveries made by medieval Muslim scholars, characteristic of the second edition, continues to be the guideline of the third edition too. This misguided presentation of the many impressive achievements of scholars from past Islamicate societies precipitates many exaggerations according to which Muslims laid the foundations for almost every science of today, invented almost every important technological device or gadget in use today, or revolutionized everything they learned from writings of scholars who lived before the seventh century or outside the realm of what is dubbed in the book ‘the Muslim world’. In short, the companion book with its texts, images, and blurbs suffers from a severe case of ‘Muslim precursortitis’, to pick up an ironic term used by Abdelhamid Sabra many years ago in his much appreciated criticism of our own research practices as historians of science in Islamicate societies. As the academic field itself, regrettably, the book suffers in addition from Phil-Arabism, to the detriment of other peoples and communities that contributed importantly to the sciences and technologies of past Islamicate societies. Again, as the academic field itself, regrettably, the book exhibits widespread disinterest in the precise historical contexts of the various scholarly activities and their results, and sadly reflects the shortcomings of academic research on past sciences and technologies in Islamicate societies. The serious errors by the book’s compilers and editors are, however, not caused by any of my colleagues, despite Salim al-Hassani’s repeated protestations. In contrast, it is both annoying and sad that *1001 Inventions* misses the chance to popularize the many profoundly new discoveries by historians of science concerning the ideas and practices of scholars in medieval societies of Europe, Asia, and Africa; and that instead it misrepresents the past, deriving false pride and pleasure, rather than learning and teaching how to respect, appreciate, and admire past scholars in their own contexts.

Since *1001 Inventions* contains on almost every page substantial errors, misrepresentations, or, sadly, sheer inventions of its own, I have compiled a list of some of its major falsehoods, myths, and delusions without trying to achieve completeness and append it at the end of my discussion of the book's messages, rhetoric, imagery, and other features. It is most regrettable that the National Geographic Society lent its authority to promoting this kind of ideological misrepresentation of an important part of the history of science. No amount of political correctness and nicety about cultural cohesion and mutual understanding can counterbalance the ideologically based and amateurishly executed falsifications of history and science that dominate this book from page 1 to page 351.

The Politics of *1001 Inventions* and its Changing Messages

The exhibition '1001 Inventions' began modestly in London (Croyden), and has since then, in a larger and more ambitious format, toured several countries and cities (London, Science Museum; Istanbul, Sultan Ahmet Square; New York, New York Hall of Science; Los Angeles, California Science Center; Abu Dhabi, Abu Dhabi Science Festival; Saudi Arabia, Dhahran, Saudi Aramco Cultural Program). It was endorsed or inaugurated by such high ranking politicians as the Turkish Prime Minister and the US Secretary of State. Prince Charles, the Queen, the British Parliament, and Middle Eastern royals have hosted and supported the exhibition and its organizers' messages in oral as well as written form. Most recently, it was opened 30 August 2013 at Karlstad by Åsa Hallén, Director of Värmlands Museum, Lena Adelsohn Liljeroth, Sweden's Minister of Culture, and HRH Prince Carl Philip of Sweden, the Duke of Värmland. Visitor numbers in London, Istanbul, New York, and Los Angeles ranged between 400,000 and over 2 million. This is big money, to say the least.

The third edition of the companion book shows a major improvement in design, imagery, and quality of paper. The second edition had too much text and image per page and worked with too many newly made drawings and paintings in Orientalist style with false cultural elements. The third edition continues to work with fictitious pictures called artist's impressions. But they are less numerous. Those newly introduced are less glaringly Orientalist or Multiculturalist. Those retained from the second edition continue to represent their themes in a style heavily reminiscent of the Orientalist painters of the 19th century. The majority of the images are reproductions from

manuscripts, early modern printed books, photographs of today's objects, and diagrams. While most of the false cultural visual elements were taken out, a few remain: for instance, on page 89, quills are portrayed as writing utensils instead of the reeds used in Islamicate societies and women are shown as scholars working side by side with men in an observatory.

Two major problems continue to be inscribed in the visual presentation of the companion book. These two problems are found in the texts too. One consists in the modernization of medieval ideas, methods, instruments, work places, and practices. A glaring example is the diagram of the blood circulation [167]: it suggests that Ibn al-Nafis described the small blood circulation through the heart and the lungs. This is, however, false as Emilie Savage-Smith and other historians of medicine have argued. The text, moreover, places Ibn al-Nafis' work in a tradition of anatomical research, while his speculative ideas evolved in a religious context of reflections on the soul, as Nahyan Fancy has explained in his doctoral thesis [2013].

The second problem with images and texts consists in their suggesting false claims. An apparently Oriental miniature [277] shows three men dressed in Muslim garb holding big telescopes before their eyes to observe the sky. The caption seems to clarify that the miniature is fictitious by describing it as 'Ottoman-style'. But since the otherwise usual label that the image had been drawn by an artist is missing, the uninformed reader could easily conclude that the image is a genuine product of some long dead Muslim miniature painter. Worse, s/he might be tempted to believe that Muslim men indeed studied the sky with telescopes in the 17th century. Such a claim is not backed by evidence in Arabic, Persian, or Ottoman sources, although telescopes were sold by merchants and carried along by travelers from various European cities in the Ottoman Empire as well as the Indian Subcontinent. We only know for certain that telescopes were used for observations of the sky by Muslim and Hindu scholars and princes in the early 18th century.

Modernization, false claims, the omission of almost all context, the neglect of chronology, and the treatment of the many different Islamicate societies as if they had been one single whole unchanged over time except for the gloriously continuous scientific and technological progress are the major setbacks of the companion book. They are not merely accidents of sloppy work or expressions of a serious lack of competence in the topics presented

in the book. They are that too. But first and foremost, they are results of the overall message that the originators of the exhibition and the companion book wish to disseminate. It is summarized on the book cover:

IMAGINE IT IS THE SEVENTH CENTURY. As most of Europe continues its descent into a long period of intellectual dormancy, a quiet yet powerful academic revolution is erupting in another corner of the world. Over the next centuries, the geniuses of Muslim society will thrust the boundaries of knowledge forward to such a degree that their innovations still shape civilizations to this day. The staggering achievements of these men and women influenced the development of modern mathematics, science, engineering, and medicine. *1001 Inventions: The Enduring Legacy of Muslim Civilization* sheds new light on this golden era that was once lost to so many, and celebrates the heritage we all share.

I have often been asked by friends and strangers alike whether it is true that Muslim scholars contributed significant achievements to various intellectual domains, particularly, in mathematics and the sciences. When I confirm that this was indeed the case, the follow-up question often is: 'What has remained from these contributions in our current scientific and mathematical practices and theories?' Here, however, I have felt compelled to answer 'Very little'. Almost everything that pre-modern Muslim and non-Muslim scholars in Islamicate societies had studied, reflected upon, and written down or transformed into instruments, maps, or globes belongs to achievements in human intellectual development that have been replaced, invalidated, or made irrelevant to today's concerns. I am hard pressed to find a single item, be it theoretical or practical, in today's mathematics and sciences that could rightfully be claimed as a pre-modern contribution from an Islamicate society. I am of course referring here to those parts taught at universities and discussed by researchers. My answer would be slightly richer were I to restrict the question to matters taught at primary and secondary school levels. Although here, too, nothing is identical with ideas, methods, theories, or modes of notation as found in Arabic, Persian, or Ottoman-Turkish manuscripts, on instruments or in maps, the parentage of those older layers of knowing and doing can still be recognized if we carefully investigate those matters.

Such a careful investigation and appropriate appreciation of the intellectual concerns of mostly men and very rarely women in pre-modern Islamicate societies was not, however, the goal of the presenters of '1001 Inventions'. Its story is not one of manifold efforts, failures, obsolete theories, creative appro-

priations, new insights, original results, and nasty conflicts in very different societies, communities, territories, and periods. It is a single, unified tale of geniuses, as the back cover of the companion book states. It is a story of heroism and glory. The result of this aggrandizement permeates all levels of the exhibition and its companion book. It is exemplified by gross simplifications, almost complete decontextualization, staggering exaggerations, and bizarre fictions. As a colleague said to me when talking about the second edition: '1001 Inventions is the modern form of 1001 Nights.' It is a fairy tale about the glamorous, all-knowing, perpetually revolutionizing orient. It is Orientalism pure, not by Orientalists but by Muslim amateurs, by believers in a lost splendor of what they consider their past. It is a Muslim-centric, anachronistic tale about a past invented for improving the reputation of the religious creeds that they adhere to and the cultures that they grew up in or are connected with through many family ties and other links. It is a call for overcoming a widespread feeling of inferiority by stressing an imaginary superiority of a long gone past that the narrators claim continues to live in today's sciences and technologies.

This web of ideological commitments and goals was explicitly described in the second edition [al-Hassani 2007]. In the third edition, produced for and with the National Geographic Society, most of these messages are no longer explicitly made. They were replaced in Roland Jackson's foreword by a new central message and in al-Hassani's introduction by modified versions of previous statements and newly formulated goals. al-Hassani now writes, for instance:

A number of colleagues well established in the subject, began a lecturing campaign in Britain, Europe, and abroad. A large number of people from all walks of life derived pleasure and inspiration from this knowledge. Presentations to the younger generation, especially the ones I gave to the Youth NGOs at the European Parliament in Brussels, sparked enormous interest in science and technology, and especially in the lives of Muslim pioneers in chemistry, physics, medicine, biology, algebra, engineering, architecture, art, agriculture, and its numerous manufacturing industries who have impacted so positively on our modern civilization. It was clear this under-appreciated subject was finally coming of age....The first two editions of the 1001 Inventions books sold more than 100,000 copies. However, this was just the start of what would be a much greater flowering of international interest in our work, alongside increased dialogue about the cultural roots of science and new opportunities to promote social cohesion and intercultural respect and appreciation....The book identifies in an

enjoyable, easy-to-read format aspects of our modern lives that are linked with inventions from Muslim civilization. It is our hope that through those pages we can enhance intercultural respect while at the same time inspire young people from both Muslim and non-Muslim backgrounds to find career role models in science, technology, engineering, and mathematics. [13]

In the second edition he had written:

A number of colleagues well established in the subject, began a lecturing campaign in Britain, Europe and abroad. A large number of people from all walks of life derived pleasure and inspiration from this knowledge. Presentations to the younger generation, especially the ones I gave to the Youth NGOs at the European Parliament in Brussels, sparked enormous interest in science and technology, and especially in the lives of Muslim pioneers in chemistry, physics, medicine, biology, algebra, engineering, architecture, art, agriculture, and its numerous manufacturing industries who have impacted so positively on our modern civilization. Young Muslims, however, find in such knowledge a new identity, allowing them to be European whilst at the same time Muslims. They find exciting role models, male and female, for innovation and invention, and begin to recognize that these pioneers, unlike many today, had expressed their religious commitment and faith through deeds useful to society, be it Muslim or non-Muslim, and that ineptness, looking inwards and reliance on governments was not their tradition....The book identifies, in an enjoyable, easy-to-read format, aspects of our modern lives that are linked with inventions by Muslims or were inspired by Islam....Amongst the main objectives we hope to fulfill are:...Inspire young people from both Muslim and non-Muslim backgrounds to find career role models in science and engineering. [7]

Jackson, the Chief Executive of the British Science Association, also emphasized two of the new points found in al-Hassani's rewritten introduction. He praised *1001 Inventions* as

a tribute to the efforts of the Foundation for Science, Technology and Civilisation in promoting the cultural roots of science as a means of encouraging intercultural respect and appreciation and in helping us understand the past to build a better future together. [6]

As I have stated already, these modified messages do not permeate the body of the exhibition and its companion book. The concepts of cultural roots and intercultural respect and appreciation function merely as rhetorical devices of a special kind of political language. They can be appreciated as a rejection of the abusive political language against Muslims in much of Europe, the Americas, Australia, and parts of Asia. But here they did not guide the

presentation and, hence, the understanding of past intellectual and technical activities in Islamicate societies and their possible connections with our lives around the globe today. They seem instead to be an ill-conceived attempt to understand the cultural roots of science that is hobbled by limiting the project's content to 'Muslim inventions'.

As the texts of exhibition and companion book amply demonstrate, the editors of *1001 Inventions* believe in a cumulative, universal science and technology that they claim was directed for 1,000 years by Muslim scholars, men and women. They believe that the existence of one piece of knowledge or one technical device at two different places and two different moments of time proves the two are connected and that one is the direct heir of the other. They do not try to trace the cultural conditions and forms of such knowledge or artisanal production in specific past contexts in societies with either Muslim minorities or majorities. Nor do they undertake any serious effort to demonstrate the historical connections between such forms of past knowledge and objects with those of today. The editors' essentialist rhetoric of one single 'Muslim civilization' and 'Europe' demonstrates a failure to understand the particularities of any of the societies within the two big cultural blocks that they posit so uncritically as well as their lack of any awareness that these concepts belong for many academic historians nowadays to a phase of conceptualizing the 'Old World' and its various parts that is long past and best forgotten. The result of their old-fashioned and outdated approach to history is a use (or abuse) of the past in proposing that it shaped a general, unified, high-tech present and for demanding tribute to 'Muslim geniuses' as ground-breaking creators of our own times.

Thus, the project's ideological orientation has four main outcomes, none of which is commendable:

- (1) the omission of all conflicts and rejections of scientific, philosophical, and medical doctrines and practices that were part and parcel of the intellectual struggles in past Islamicate societies;
- (2) a silence about the many 1000s, if not 100,000s of elementary texts that are contained in numerous libraries across the globe and speak of the often very limited mathematical and astronomical knowledge taught in many cities and towns of Islamicate societies;
- (3) the suppression of all intellectual fields that are no longer considered sciences; and

- (4) an unwillingness to engage with hotly debated historiographical problems, thus oversimplifying past and present grossly.

Any history that starts with philosophy, medicine, mathematics, or technology in ancient Greece and continues with the Renaissance is rightly called Eurocentric and would be rejected by many of my colleagues. Likewise, a narrative that admits pre-Islamic antecedents of philosophy, medicine, and the mathematical sciences in Islamicate societies as well as non-Muslim contributors to the intellectual life in those societies but develops its main narrative thread by effectively denying these antecedents and largely ignoring those contributors is equally unacceptable. Many Islamicate societies, however, had no notable groups of scholars or craftsmen who could have made it into the pages of *1001 Inventions*. Others had notable scholars but in fields which do not interest the editors of *1001 Inventions* at all—the religious sciences, history, rhetoric, philosophy, philology, astrology, alchemy, letter magic, and related areas. Terms like ‘chemistry’, ‘physics’, ‘biology’, ‘engineering’, ‘manufacturing industries’, ‘robot’ describe historical states reached first in some non-Islamicate societies in Europe between the late 18th and 20th centuries. *1001 Inventions*’ historiographical one-sidedness also extends to almost all neighbors and contemporaries of Islamicate societies with one exception: ‘Europe’. Its editors have little to no interest in processes of exchange between different societies in Asia or Africa.

The ideological goal of the exhibition also finds its expression in the themes chosen for representation. Except for the newly added ‘Map of Major Contributions in Muslim Civilization’ and ‘Chapter One: The Story Begins’, companion book and exhibition cover seven domains: Home, School, Market, Hospital, Town, World, Universe. Disregarding the slightly unfortunate choice of ‘World’ and ‘Universe’ for the last two domains, this structuring of the material is appealing in its simplicity and apparent clarity. The subsections, however, indicate the problems with this structure. To include, for instance, ‘the agricultural revolution’, farming manuals, water management, dams, or windmills under the header of ‘Market’ comes as a surprise and cannot be defended on grounds of content or historical conditions, to say nothing here of the deeper issue of calling agricultural changes and innovations in the medieval period a ‘revolution’. More than one subsection has next to nothing in common with either ‘science’ or ‘technology’, whether understood as medieval or current phenomena, since they do not discuss issues like nu-

trition, weaving or spinning technologies, procedures of dying, color and ink production, or methods for differentiating between true gemstones and fakes. Without aiming for completeness, I mention the following examples:

- chapter 2 (Home): ‘The Coffee Trail’, ‘Fine Dining’, ‘The Three-Course Meal’, ‘Carpets’, or ‘Fashion and Style’;
- chapter 3 (School): ‘Chess’, ‘Art and Arabesque’, ‘The Scribe’, or ‘Word Power’;
- chapter 4 (Market): ‘Jewels’ and ‘Currency’; and
- chapter 5 (Town): ‘Public Baths’ or ‘From Kiosk to Conservatory’.

Hence, contrary to the opening claim of chapter 1.1 ‘The Golden Age’—‘This volume looks at the scientific legacy of Muslim civilization...’ [18]—*1001 Inventions* does not focus on scientific discoveries and technological inventions alone but presents many cultural items produced in other contexts in various Islamicate societies and appropriated in non-Islamicate societies in Europe through trade, war, conquest, diplomacy, travel, and transfer of ideas, to use major terms of the companion book. This imbalance between title, messages, and content is only one of the many signs of questionable work by editors whose efforts are otherwise undeniable.

Verification, Witnessing, and Rhetorical Devices

1001 Inventions and its parent organization, the FSTC, claim time and again to rely exclusively on the best scholarship available. The list of errors bespeaks the deep-seated problems that the makers of the companion book and exhibition have with serious scholarship. Another indicator of the enormous distance between the tales of *1001 Inventions* and academic scholarship is the primary reliance on journalists, TV series, and educators; moreover, on those rare occasions when they do turn to a historian, it is to historians of science in the 19th and early 20th centuries. The lack of any precise referencing and the substitution of more cautious statements from academic sources to the effect that someone may perhaps have done or written something with statements of bald fact exacerbate this sad situation. Except for one historian of engineering, the late Donald Hill, not a single one of my numerous colleagues who have changed our knowledge of the scholarly works undertaken in classical and some post-classical Islamicate societies has been given voice. The subsection on mathematics of chapter

3 (School) is recognizably based on the work of the Egyptian historian of mathematics Roshdi Rashed but without crediting him [84–86].

I have repeatedly tried to verify the companion book's most dubious factual claims but was often unable to find out whence the authors of the texts appropriated them or to find any source coming close to what was claimed. The quotations in the blurbs on the book's cover as well as in its main body are often, but fortunately not always, even 'more false' than *1001 Inventions* itself or simply serve the purpose of supporting its various exaggerations and errors.

Three sets of examples have to suffice to illustrate this feature of the blurbs:

- (1) Brian Whitaker, a journalist of the *Guardian*, is quoted for his account of the House of Wisdom:

The House of Wisdom was an unrivaled centre for the study of humanities and for sciences, including mathematics, astronomy, medicine, chemistry, zoology and geography...Drawing on Persian, Indian and Greek texts—Aristotle, Plato, Hippocrates, Euclid, Pythagoras and others—the scholars accumulated the greatest collection of knowledge in the world, and built on it through their own discoveries. [73]

As I will elaborate below, this institution was a library, not a research institution. The few translations explicitly linked to it were made primarily from Middle Persian texts, mostly on astrology; there were no such things as humanities, chemistry, or Indian texts as a parallel to Persian and Greek texts, but Sanskrit texts. The names given are actually authors, not texts, and all of them are Greek. There was no genuine text by Pythagoras known in Antiquity and, hence, none was translated into Arabic. It is highly doubtful that the material, mostly letters and documents, stored in the caliphal library can be called 'the greatest collection of knowledge in the world'. But even if we take this superlative to concern the texts composed by Christian, Jewish, Zoroastrian, Sabian, or Muslim scholars during the eighth and ninth centuries, it still remains questionable whether the knowledge taught in Indian or Chinese cities of the period can be measured sensibly and, hence, described as less than the one praised in the quotation.

- (2) Rageh Omaar, then a BBC journalist, today with al-Jazira English, and *1001 Inventions*' most favored witness, has pronounced numerous absurdities in his TV documentary 'An Islamic History of Europe'

for BBC Four (August 2005), which are repeated in the book, among them the following three:

- (a) Teams of Muslims, Jews, and Christians translated texts into Arabic, then into Castellan Spanish and Latin. It required close cooperation and religious tolerance. The Andalusian word for this is ‘convivencia’ and means ‘living together.’ [82]

I am not aware that a single text was translated in Toledo into Arabic by a team of Muslims, Jews, and Christians. In the ninth and tenth centuries, some Latin texts were translated by Christians or newly converted local Muslims into Arabic but it is not clear that this happened in Toledo and it was not a part of the events of the 12th and 13th centuries to which the quotation refers. ‘Castellan’ designates the administrative head, so to speak, of a castle not Spanish, while Castilian is the language meant here: if ‘castellan’ is meant as the Castilian word for the language it should be ‘castellano/a’ depending on the genus of the noun with which it is linked. In any case, Castilian Spanish is an improper doubling of two names for the same thing when looked at from outside Spain. ‘Convivencia’ is not an Andalusian but a Castilian word and it was introduced into the historical debate in the first half of the 20th century. We know of only a few cases of cooperation in translating Arabic texts into Romance and then Latin between Jews and Christians in Toledo, even less of the cooperation between a foreign and a local Christian, and, as far as I am aware, nothing of any cooperation between a Muslim and a foreign Christian. We know of other cases of such cooperation outside of Toledo, for instance, in Barcelona or in the Ebro valley; but this kind of reliance by foreign as well as local Christians on the skill and knowledge of Jewish scholars and Muslim speakers of Arabic is not called ‘convivencia’, a term used for the relationship between members of the three religions under Muslim rule. Even if the quotation is meant to refer to the translations made at the court of Alfonso X in the 13th century, no Muslim participated in them and the number of translated texts, while greater than in many other cases, remained nonetheless fairly limited.

- (b) He [Averroes] would launch Paris as the intellectual capital of Europe...Averroes was trying to defuse a conflict between science and

religion because the truth revealed by science was often at odds with the truth of divine revelation. This attempt had the opposite effect when his ideas came to the attention of the Christian church. They immediately banned Averroes [*sic*] and Aristotle's works. The Paris intellectuals fought back and a debate raged for years. [83]

Ibn Rushd never came to Paris nor could he launch the city as the intellectual capital of Europe, which in itself is a gross exaggeration. The description of Ibn Rushd's discussion of the relationship between law and philosophy is old-fashioned and contradicts what the philosopher wrote in his work *Kitab fasl al-maqal*.¹ The Christian church is not 'they' and it did not ban Averroes' and Aristotle's works immediately. The first time that works by Aristotle were condemned was in 1210: the condemnation was pronounced by the Synod of Sens and referred exclusively to the Faculty of Arts at the Sorbonne. Philosophical positions maintained by Ibn Rushd (doctrine of the soul, monopsychism) and Aristotle (God as Unmoved Mover) were banned 60 years later by the bishop of Paris Étienne Tempier, who headed a group of theologians appointed by him for this purpose.

- (c) The staggering array of geometric patterns shows the way the Muslim craftsmen explored the concept of infinity through mathematical repetition. [101]

Muslim craftsmen in Fez, for instance, have wooden models which they simply copy, one after the other; no exploration of anything is involved. Moreover, the journalist has no grasp of infinity, since it cannot be explored by anyone through repetition but by abstract thought alone. Amani Zain, presenter in 2005 of the BBC Documentary 'What the Ancients Did for Us', claimed: 'Arabs invented the technique that makes these clay pots into art' [142]. The subject of this false and at the same time ridiculous claim is luster glaze, the first appearance of which seems to have been on glass, not pottery. There are different theories of who invented the technique—Romans, Copts long before the Arabic conquest of Byzantine Egypt, or ethnically unspecified craftsmen,

¹ There is an English translation at <http://www.fordham.edu/halsall/source/1190averroes.asp>.

maybe Copts, maybe, but less likely, Arabs, or even alchemists in early Islamic Fustat (today part of Cairo) as claimed in the very same BBC documentary. Pottery, however, was produced as an art form millennia before the advent of Islam.

- (3) (a) Ruth S. Mackensen, an early 20th-century historian, writes:

Books were presented and many a scholar bequeathed his library to the mosque of his city to ensure its preservation and to render the books accessible to the learned who frequented it. And so grew up the great universities of Córdoba and Toledo to which flocked Christians as well as Moslems from all over the world. [70]

General statements like the first sentence of this quotation are difficult to prove or disprove: there are many mosques today with none or very small holdings of books compared to a few famous ones with collections of 100s and in some cases 1000s of manuscripts. When the habit of donating a private collection of manuscripts to a mosque or a *madrassa* emerged is not clear, but it differed in all likelihood from region to region. My vague impression is that it became more customary with the foundation of *madrasas*, i.e., *circa* the 12th and 13th centuries, but I may be wrong. The second sentence of the quotation, however, is utter nonsense: there were not only no universities in Cordoba and Toledo under Muslim rule; there was also no flocking of people, whether Muslim or Christian, from all over the world either under Muslim or under Christian rule. This is simply a careless exaggeration of what is known about Muslims from different regions (al-Andalus, the Maghrib, Egypt, Iraq, and occasionally even Iran) who visited scholars in cities of different Islamicate societies in order to study with them a set of specific texts.

- (b) S. P. Scott, a 19th-century historian, writes:

The Spanish Muslims' agricultural system was the most complex, the most scientific, the most perfect, ever devised by the ingenuity of man. [113]

Even for the later 19th century, this statement is wrong—too much praise and too little rational analysis. Today it is an even less appropriate evaluation in its timelessness, lack of context, and lack of reliable comparison with other forms of agriculture.

One of the most tiresome features of the companion book is the constant use of superlatives coupled with the emptiness in content of many of the sentences. The formulas used continuously serve to suggest academic reliability and familiarity with the latest research results. But their references remain either unspecific or point to manuscripts with vague dates, no authors, no titles, and no locations of preservation. No reader could ever check such claims nor learn more about the sources used. The words and phrases most loved by the Chief Editor al-Hassani and his team are: 'huge', 'vast', 'amazing', 'ground-breaking', 'buzzing', 'bursting', 'powerhouse', 'greatest', 'largest', 'oldest', 'richest', 'revolutionize', 'revolutionary', 'the first', 'the founder', 'laying the fundamentals', 'incredible', 'massive', 'hundreds', 'thousands', 'golden age', 'rational thought', 'experimentation', 'direct observation', 'breathtaking', 'brilliant', 'gifted', 'public', 'global', 'when Muslims are concerned', and flocking to some place in the 'Muslim world' when 'Europeans' were the subject at hand.

Consider, for example, the following three statements:

- (1) The ethos of learning was a culture where inquiring minds searched for truth based on scientific rigor and experimentation, where opinion and speculation were cast out as unworthy pupils. This system of learning embodied by medieval Islam formed the foundation from which came exceptional inventions and discoveries. [63]

Whoever came up with this description has never read a biography of a medieval scholar that describes the standard learning methods such as memorizing a chapter or, in the more demanding circumstances, an entire treatise, listening to a teacher reading a text aloud and commenting on it word by word so that the students could write it down carefully for later remembrance, and studying one and the same elementary text on arithmetic, algebra, astronomy, or medicine more than once with different teachers. Neither did the writer ever bother to read any of these elementary school texts that fill manuscript libraries across the globe in great number, outweighing by far anything that might count as exceptional.

- (2) Muslim learning hit [!] medieval Europe in the 12th century. A massive [!] translation exercise [!] began of Arabic works from the previous 500 [!] years into medieval Latin, making available the rational ideas from experiments [!] to a new audience. The availability of well-referenced material kick-started [!] European tertiary education [!] and questioned the idea that there had to be conflict between religion and

science [!]. At Chartres [sic] cathedral school in the 1140s, Thierry of Chartres taught that the scientific approach [!] was compatible with the story of creation in the Bible, paving the way for the Renaissance [!]. The first university in western Europe was at Salerno in Italy, which burst [!] into life in the late eleventh century after the arrival of Constantine the African. The French city of Montpellier was an offshoot of Salerno and a major center for the study of Muslim medicine and astronomy. It was close to Muslim Spain, with its large population of Muslims and Jews. By the beginning of the twelfth century, the intellectual powerhouse [!] of the Western world had shifted to Paris, ‘a city of teachers’, as the knowledge of Arabic works continued to spread with traveling scholars. Indeed, many historians today say that the blueprints [!] of the earliest English universities, like Oxford, came with these traveling, open-minded scholars and returning Crusaders who, as well as visiting Muslim universities in places like Córdoba, brought back translated books based on rational thought rather than confined to religious thought. [71]

The exclamation marks are meant to highlight some of the aforementioned vocabulary of exaggeration, modernization, and utterly improper representation of medieval times. Muslim learning did not hit Europe whatever the date, neither did it arrive in Europe only in the 12th century: the first Arabic texts on the ancient sciences arrived on the Iberian peninsula in the ninth century and on Sicily at the very latest a century later. The translations were not an exercise but a serious undertaking of many individuals, most of whom we do not know by name. The texts translated into Latin covered primarily astrology, magic, and divination. Treatises on what we consider today as scientific were translated on a much more modest scale. But even those that we acknowledge today as scientific did not make available rational ideas from experiments so much as rational ideas based on axiomatic systems like Euclidean geometry or on astronomical observations, cosmological theories, mathematical models like those in Ptolemy’s *Almagest*, as well as on philosophical or medical theories found in works by Aristotle, al-Farabi, Ibn Sina, Ibn Rushd, al-Ghazali, Zakariya^a al-Razi, ^cAbbas al-Majusi, and others. Mediaeval Arabic or Persian scholarly texts, whatever their field of knowledge, are often not well-referenced: many of their borrowings remained anonymous. Salerno’s university was founded in

1968. Constantine the African was perhaps a Christian but we do not really know much about his life in North Africa and how he came to arrive at Salerno around 1070. The many tales about him that can be accessed on the Internet are unreliable: he produced his translations of Arabic translations of Greek medical texts as well as newly composed Arabic medical texts based on Greek theories most likely at the Benedictine monastery of Monte Cassino. The city of Montpellier was not an offshoot of Salerno: it was mentioned already in the late 10th century. Since Montpellier's medical school was only founded in 1220, it is equally impossible that it was an offshoot of Constantine the African's translations at Salerno; indeed, their professors did make use of Latin translations of Arabic texts in their teaching of medicine but their teaching of astronomy was a kind of preparation for studying astrology that was needed for predictions and diagnosis. Thierry of Chartres did not write about the relationship between the scientific approach and the *Bible* in his *Heptateuchon*, in which he included texts translated from Arabic (translated from Greek or newly composed) on the Iberian peninsula; he rather wrote on the relationship between the *trivium* and the *quadrivium* and the use of arguments from the quadrivial disciplines (number theory, geometry, astronomy, music) for proving claims about God. Neither he nor his works paved the way to the Renaissance. The claim that Paris had become the 'intellectual powerhouse of the Western world' at the beginning of the 12th century contradicts the previously quoted claim by Ragheb Omaar that Ibn Rushd had 'launched' the city as such in the 13th century. Moreover, the Western world did not yet exist as a cultural, economic, or political concept. I could not find any contemporary historian who actually believes that 'open-minded scholars and returning Crusaders' brought a 'blueprint' for Oxford's university from the Muslim world in the 12th century. There are historians like Charles Burnett who have argued for the possibility that copies of Arabo-Latin translations came to England *via* Paris and Mont St Michel but this is a different kind of claim and evidence. The early history of Oxford University is not well documented: there

is reason to believe that it grew out of older monasterial schools in the region.²

- (3) There are quite a few mathematical ideas that were previously be thought to have been brilliant conceptions of 16th-, 17th- and 18th-century Europeans. From the studying and unearthing we now know that Muslim mathematicians, about four hundred years earlier, were calculating with great intensity. Many of these mathematicians came from the Iraq/Iran region around 800 CE, when the House of Wisdom was the leading intellectual academy in Baghdad. [65]

This passage is utterly confused in dates, concepts, and geographies. In the calendar that I use, the 16th century came 700 years after 800; hence, the intensely calculating mathematicians of the 12th century cannot have worked at the House of Wisdom. Moreover, it remains unclear who these calculating hotheads were; I at least cannot offer even a single name as a candidate for the honor, at least not for the ninth or 10th centuries. The 13th or 14th centuries would be another matter: here I could point to at least two *muwaqqits* (scholars who had special expertise in the astronomical, geometrical, and arithmetical methods as well as in the instruments used for determining prayer times, the prayer directions towards Mecca, and the beginning of a month), namely, Shams al-Din al-Khalili and Najm al-Din al-Misri, about whom David King and François Charette have written important works apparently unknown to the author of the subsection on mathematics. The Iraq/Iran region is rather large and certainly much, much larger than Baghdad—maybe the author simply wished to indicate that numerous scholars in eighth- and ninth-century Baghdad had come from what we call today Iran and Iraq but botched the sentence. Finally, whether some Muslim mathematicians calculated whatever it was with great intensity—does this mean that they calculated very fast or very much or with great passion?—has nothing to do with mathematical ideas or brilliant conceptions. These are rather two different conceptual levels: on the level of English, unearthing has to come before studying; on the level of material objects, very few of such manuscripts have in fact been unearthed or excavated, since they are preserved in libraries and are to be found in catalogues or on shelves, if possible.

² <http://www.newadvent.org/cathen/11365c.htm>.

Editorial issues

The editorial efforts to produce a better version of the companion book are clearly visible and are substantial, in particular in regard to English. Nonetheless, the editors did not manage to purge the 351 pages from every misuse of the English language or all the misunderstandings of mathematical and scientific topics or technical works. Some examples are:

(1) English:

- ‘For the last eight centuries, chess has gone from strength to strength, producing a few funny stories along the way,...’ [47];
- ‘These medieval brains met every day for translating, reading, writing, and discourse’ [72];
- ‘...al-Kindi, who commissioned the translation of Aristotle, and Hunayn ibn Ishaq, who translated Hippocrates’ [74];
- ‘Ibn al-Haytham did his experiments in complete darkness,...’ [80];
- ‘As well as Michael Scott and Daniel of Morley, the city of Toledo was buzzing with contemporary translation scholars’ [83].

(2) Arabic:

- ‘were known as the Banu Musa brothers’ [52–53];³
- ‘halaqa’ [70] for ‘halqa’;
- ‘Algebr wal Muqabala’ [23] should be transliterated as ‘al-Jabr wa’l- muqabala’; the Arabic article ‘al’ is not spelled with capital ‘A’ in transliteration;
- ‘al-Mu^ctadid’ not ‘al-Mu^otadhid’;
- ‘Harun al-Rashid’, not ‘al-Rashid’ [72].

(3) Geography/history:

- ‘From Andalusia, the game spread among Christian Spaniards and the Mozarabs...’ [47]: the Mozarabs were Christians who lived across the Iberian peninsula and who differed from other Christians by having adopted Arabic and major elements of the culture of their Muslim neighbors;
- ‘Carpets were first made before Islam by the Bedouin tribes of Arabia, Persia and Anatolia. They used carpets as tents, sheltering them from sandstorms...’ [60]: there are no sandstorms

³ ‘Banu’ means ‘brothers’.

in Anatolia and pre-Islamic tribes in Anatolia and Iran are not labeled Bedouin;

- ‘The critique and commentary on Aristotle by Ibn Rushd,... was the real start of Europe’s classical revival, and this 200 years before the start of the European Renaissance’ [82]. Ibn Rushd’s commentaries were translated in the early 13th century into Latin as well as Hebrew. Regrettably, the role of such Hebrew translations of Arabic texts is not a part of the book’s tale; indeed, in this tale, neither Jews nor Muslims were a part of European culture/s. Further, before the translation of Ibn Rushd’s works, during the 12th century, many other Arabic texts had been translated into Latin. Hence, the claim of a ‘real start of Europe’s classical revival’ with Ibn Rushd is false and misleading in more than one respect.

(4) Sciences, mathematics, technologies:

- al-Khwarazmi’s algebra

was a revolutionary move away from the Greek concept of mathematics, which was essentially based on geometry. Algebra was a unifying theory that allowed rational numbers, irrational numbers and geometrical magnitudes to all be treated as ‘algebraic objects’. It gave mathematics a whole new dimension and a development path, much broader in concept than before. It also enabled future development. Another important aspect of the introduction of algebraic ideas was that it allowed mathematics to be applied to itself in a way that was not possible earlier. The torch of algebra was taken up by the successor of al-Khwarizmi, a man called al-Karaji, born in 953 CE. He is seen by many as the first person to completely free algebra from geometrical operations and to replace them with the arithmetical type of operations which are at the core of algebra today. He was first to define the monomials x, x^2, x^3, \dots and $1/x, 1/x^2, 1/x^3, \dots$ and to give rules for products of any two of them. He started a school of algebra which flourished for several hundred of years. [64]

Scholars of Islamicate societies had no concept of rational and irrational numbers. For them, algebra was a branch of arithmetic, not mathematics as a whole, which either dealt with equations (in most extant texts with linear and quadratic equations) or which focused on operations with exponents of integers or frac-

tions with a numerator = 1, their sums, products, and quotients. Algebra remained a much less well grounded part of mathematics than geometry for scholars who wrote in Arabic, Persian, or Ottoman Turkish. Even authors like al-Karaji, who was *not* the direct successor of al-Khwarizmi, appreciated geometry more highly than algebra because of the former's solid axiomatic and deductive foundation. R. Rashed's belief that he freed algebra from geometry was and is not shared by many historians of mathematics in Islamic societies: the 'arithmetical type of operations' that al-Karaji used in his algebraic treatise is not that of modern algebra, since modern algebra has a profoundly different character than that of any medieval Muslim writer on the topic. Further, the powers of integers and fractions were not introduced first by al-Karaji but can be found already in Diofantus' *Arithmetica*. This also applies to their products. Again, al-Karaji did not found a school of algebra and al-Samaw² al in the 12th century was not 'a member of al-Karaji's school'. The nonsensical claims about the developmental path, the much broader concept of mathematics, and the opening up of the future that set algebra apart and above geometry do not deserve any serious comment.

- The first Muslim, and perhaps person, to make a real attempt to construct a flying machine and fly was Cordoban ^cAbbas ibn Firnas in the ninth century. He was the usual polymath of the time, becoming a renowned poet, astrologer, musician, astronomer, and engineer. But his greatest fame was for constructing a flying machine, the first of its kind capable of carrying a human into the air. He flew successfully a number of times over desert regions, improving his designs before attempting his two famous flights in Córdoba in Spain. The first flight took place in 852, when he wrapped himself in a loose cloak stiffened with wooden struts and jumped from the minaret of the Great Mosque of Córdoba. The attempt was unsuccessful, but his fall was slowed enough that he got off with only minor injuries, making it at least one of the earliest examples of parachute jump....Ibn Firnas was one to learn from experience, and he worked hard to improve his next design. Accounts from various eyewitnesses and medieval manuscripts described it as a machine consisting of large wings. So about 1,200 years ago, the nearly 70-year-old ^cAbbas ibn Firnas

made a flight machine from silk and eagle feathers. In the Rusafa area on the outskirts of Córdoba, Ibn Firnas mounted a hill and appeared before the crowd in his bird costume, made from silk covered with eagle feather, which he tightened with fine strips of silk. Ibn Firnas explained with a piece of paper how he planned to fly using the wings fitted on his arms: 'Presently, I shall take leave of you. By guiding these wings up and down, I should ascend like the birds. If all goes well, after soaring for a time I should be able to return safely to your side.' He flew to a significant height and hung in the air for more than ten minutes before plummeting to the ground, breaking the wings and one of his vertebrae. After the event, Ibn Firnas understood the role played by the tail, telling his close friends that when birds land, they normally land on the root of the tail, which did not happen for him because he did not have one. All modern airplanes land on their rear wheels first, which makes Ibn Firnas's ahead of its [sic] time. [296–297]

There are a number of absurdities in this text: who ever saw a bird land on its tail? The picture on page 297 shows a swan landing where it should land: on its feet. Ibn Firnas (d. 887) could at best be said to have been ahead of his time if airplanes landed on their back. This, however, would be akin to a crash-landing: the rear wheels are the feet of the airplane, not its tail. Then, there is the issue of the contraption designed by Ibn Firnas for his imitation of birds. It certainly contained no mechanical parts and thus was not a machine. Moreover, there seem to be only two Arabic sources that record bits and pieces of the event, none of them describes it as a machine: the 10th-century historical chronicle *al-Muqtabis* by Ibn Hayyan (987/8–1076), and the 17th-century chronicle by the Maghribi scholar Ahmad Muhammed al-Maqqari (d. 1632). The latter, who was probably the direct or indirect basis for *1001 Inventions*, quotes a line in a verse of a colleague of Ibn Firnas from the ninth century and presents his view on how Ibn Firnas had not flown but glided in the air:

Among other very curious experiments which he made, one is his trying to fly. He covered himself with feathers for the purpose, attached a couple of wings to his body, and, getting on an eminence, flung himself down into the air, when according to the testimony of several trustworthy writers who witnessed the performance, he flew a considerable distance, as if he had been a bird, but,

in alighting again on the place whence he had started, his back was very much hurt, for not knowing that birds when they alight come down upon their tails, he forgot to provide himself with one. [White 1961, 101]

E. Lévy-Provençal summarizes the information from Ibn Hayyan as follows:

He (Ibn Firnas) was even a distant precursor of aviation, thinking out a sheath furnished with feathers and mobile wings; had the courage to put it on, to jump from the top of a precipice and to hover in the air for a few seconds before falling—escaping death by a miracle.⁴

Both sources hence agree that Ibn Firnas fabricated some kind of ‘bird’s costume’, as *1001 Inventions* states at one instance, too. With such a contraption he could neither have flown nor glided: the picture of a stable construction of a glider on page 298 is thus misleading.

Errors, Exaggerations, Inventions

The main editorial shortcoming is the continued presence of numerous old errors and the introduction of new ones, all indicating a low level of familiarity with history on the part of both editorial teams (the FTSC and the National Geographic Society). The Map of Major Contributions in Muslim Civilization [14–15] claims, for instance, that the mosques of Cordoba and Toledo were built using ‘gothic ribs’ which ‘inspired European architects and their patrons to use them in the Romanesque and Gothic movements’; that Ibn Khaldun’s work *al-Muqaddima* with its ideas about how societies evolve, change, and disappear ‘forms the basis of sociology and economic theory’; or that al-Idrisi produced ‘an atlas with 70 maps called the “Book of Roger”, showing that the Earth was round, which was a common notion held by Muslim scholars’.

The last claim is illustrated by a circular world map that was no part of the 70 rectangular maps to which the quotation refers. It was found several years ago in an earlier geographical work, the *Book of Curiosities*, by an

⁴ http://0-referenceworks.brillonline.com.fama.us.es/entries/encyclopaedia-of-islam-2/abbas-b-firnas-SIM_0021?s.num=0&s.f.s2_parent=s.f.book.encyclopaedia-of-islam-2&s.q=%27abbas+ibn+firnas.

anonymous Egyptian author and, thus, in all likelihood, is not al-Idrisi's creation. Since Emilie Savage-Smith, one of the scholars who edited, partially translated, and commented on the *Book of Curiosities*, was an academic advisor of FTSC and *1001 Inventions* until 2007, this incorrect ascription of the circular world map to al-Idrisi must be from an older article appropriated from FTSC's website <http://www.MuslimHeritage.com>. Furthermore, it indicates that the repeated claim by the editors of *1001 Inventions* that they rely exclusively on the best scholarly works and would publish nothing that is doubtful or not approved by leading scholars of the various historical fields cannot be trusted.

The preceding three little examples show, furthermore, that the writers of these particular snippets as well as those of many other texts are lacking in even elementary historical, scientific and philological skills and understanding. Gothic ribs were, of course, not part of Romanesque architecture. The roundness of the Earth was already believed in by scribes in ancient Mesopotamia. The issue at stake was the planet's sphericity in which many, but by no means all, Muslim scholars believed, as al-Ghazali's (d. 1111) scorn, heaped on those who did not, illustrates. Ibn Khaldun's (d. 1406) cyclical theory of society's development, which owes much to Aristotelian and other ancient Greek theories, is not the basis of today's sociological or economic theories and had—as far as I know—no impact to speak of during the 18th and 19th centuries, when predecessors of today's theories were created.

The following is a list of selected errors (big and small), mostly present in the previous edition of the companion book and now carried over in the third:

- (1) There was no 'golden age of discovery' that 'flourished from the seventh century until the sixteenth century' [17]. The standard beginning of the unfortunate historiographical metaphor of a 'Golden Age' is the early ninth century, when the bulk of translations from Greek into Syriac or Arabic and from Syriac into Arabic was produced, while its end has been determined by different historians differently (we find a trace of these different opinions on page 80, where this end is given as the 13th century). The subsequent centuries were often summarily labeled decline, a concept that has rightfully attracted much critical attention during the last decade or two when it was shown that advanced scholarly debates, in particular, on planetary theory and 'philosophical theology' (to be brief), also took place in the

16th or 17th century. The substantive contribution of this period was not so much one of discovery but one of appropriation, adaptation, amalgamation, modification, and innovation.

- (2) The labeling of the period between 450 and 1492 as ‘the Dark Ages’ was originally limited to historians of Great Britain; other communities of historians applied the term only to the early Middle Ages. Since almost half a century, at the very least, the concept of a ‘Dark Age’ representing medieval intellectual history in Europe, whatever the cultural context, has been abandoned in talk of the High and Late Middle Ages. Recently, the label has also been challenged successfully by British, German, and other historians in its application to the early Middle Ages. It remains widespread, however, among amateurs and, apparently, such would-be-historians as the now retired professor of engineering and Chief Editor of *1001 Inventions* Salim al-Hassani.
- (3) ‘The House of Wisdom’ did not bring ‘men and women together from far and wide, from all backgrounds and faiths, to work side by side to study and better understand our world’ [6]; nor was it either ‘a prestigious academy and library,...founded a thousand years ago’ where ‘Muslim, Christian, and Jewish scholars cooperated in translating knowledge, fueling scientific debate and discovery’ [18] or ‘a major center of research, thought, and debate in Muslim civilization—the intellectual powerhouse of its day’ [74]. Despite the very limited information that is provided in medieval Arabic sources about this institution, it is certain that it was founded before 833 and that it was not an academy, as it is briefly described in the first quotation from chapter 1 and the second quote from chapter 2 where it is described verbosely [72–75]. Rarely is any line on these four pages correct. Many are pure inventions. Others are shameless exaggerations. Whoever composed them must have read a novel about Baghdad’s intellectual life in the early Abbasid period. How else would s/he have come to imagine that

Caliph Harun al-Rashid,...built the scientific collection and Academy of Science. Caliph al-Ma²mun...extended the House of Wisdom and designated a section or wing for each branch of science, so the place was full to bursting with scholars or ²*ulama* [sic], art scholars, famous translators, authors, men of letters, poets, and professionals in the vari-

ous arts and crafts. These medieval brains met every day for translation, reading, writing, and discourse. The place was a cosmopolitan melting pot, and the languages that were spoken and written included Arabic (the *lingua franca*), Farsi, Hebrew, Syriac, Aramaic, Greek, Latin, and Sanskrit, which was used to translate the ancient Indian mathematics manuscripts [sic]. [72]

No mathematical text is known to have been translated in the eighth or ninth centuries from Sanskrit into Arabic. Three or four such texts were translated from Sanskrit into Persian in the 17th and 18th centuries on the Indian Subcontinent but this is a different story. ‘Ulama’ was not yet a term for scholars who worked primarily on philosophy, medicine, or the mathematical sciences. Arabic was not a *lingua franca*, albeit it became the main language of philosophy, medicine, and the sciences as a result of the many translations and the fact that Arabic was the primary spoken, religious, and administrative language of the Abbasid dynasty, although not yet of the society which they ruled. Syriac is an Aramaic dialect. Latin was definitely not spoken in Baghdad except perhaps by the occasional ambassador or merchant. Farsi is a recent silly replacement for the perfectly fine English word for this language, namely, Persian. But first and foremost, the House of Wisdom was not an academy nor a place of research. As Dimitri Gutas and Marie-Thérèse Balty-Guesdon have shown after a meticulous analysis of the extant, very limited testimonies, the House of Wisdom was primarily a library, with very few people directly connected to it either as charges of a director like the three brothers Musa (Muhammad, Ahmad and al-Hasan) after the death of their father or as directors. The few translations undertaken in this institutional context concerned mostly translations of Middle Persian (Pahlavi) astrological texts into Arabic [see, e.g., Gutas 1998, 53–60].

- (4) The remarks in chapter 1 on the universities and subsection 2 (Universities) in chapter 3 are based on the misguided assumption that the teaching institutions for higher level education that emerged over time in various Islamicate societies were the basis for the universities that were founded between the 11th and 13th centuries in Bologna, Paris, Oxford, Cambridge, Salamanca, Montpellier and other cities. Even if one followed George Makdisi and assumed an influence of *madrasa* teaching forms and methods upon some or all

of those universities, the differences in legal status, setup, structure and organization are considerable, too great to consider both types of institutions as principally the same. Universities were not founded in any Islamicate society before the second half of the 19th century. Most of them were set up only in the 20th century, often in declared contrast to the old types of teaching institutions and their methods. Old mosques and their *madrasas* received this status also only in the 20th century, often against heavy resistance of their scholars, as was the case of the al-Azhar.

Particular mistaken claims are that ‘all over the Muslim world, advanced subjects were taught in mosques, schools, hospitals, observatories, and the homes of scholars’ [68], that the *ijaza* is a certificate equivalent to a final degree like a master or a diploma [69],⁵ that there was something equivalent to a PhD called ‘Risaleh’ [sic]⁶ given after 10 years at the university of Sankore in Timbuktu, where 25,000 students studied not merely law and other religious fields, some elementary mathematics and astronomy, as well as some logic, physics, chemistry, surgery, art, linguistics, but also learned a vocation in trade, farming, fishing, shoemaking, tailoring and navigation [69]. Similarly unguarded and unjustified claims can be found on the Internet.⁷

The author of this part of *1001 Inventions* has, however, gone far beyond the modernizing aggrandizement of the level and scope of learning and scientific themes taught from the 12th to the 16th centuries at Timbuktu and elsewhere in West Africa. Not only did s/he extend the period generously to the 10th century, ignoring that Timbuktu was only founded a century later, but s/he also apparently never checked the location of Timbuktu on a map. Why someone far away from the ocean should learn anything about navigation remains a puzzle. Not being an expert on West Africa, I do not wish to express too strong a rejection of the various highly suspicious statements regarding the *madrasas* of Timbuktu. But I find it very difficult to believe that art, physics, chemistry, linguistics, and other modern

⁵ Compare the descriptions of the various kinds of teaching certificates in Islamicate societies by Adam Gacek [Gacek 2009, 51–59].

⁶ This is a Pakistani or Persian transliteration, not an Arabic one.

⁷ <http://www.timbuktufoundation.org/university.html>.

disciplines where studied there or that they offered in adjunct shops vocational training of the kinds mentioned. Neither do I give any credit to the claim that a work similar to a PhD was part of their teaching. Other claims like the one [70] that ‘baccalaureus’ derives from the Arabic expression ‘bi-ḥaqq al-riwāya’ (‘on the authority of an oral transmission’)⁸ are most likely wrong because they are based on articles that neither investigated other linguistic backgrounds of ‘baccalaureus’ nor considered the much earlier appearance of clearly related terms like ‘baccalaria’ and their possible philological backgrounds.⁹ Since about the ninth century, the owner of a *baccalaria*, a piece of land leased from a big landowner for rent, was called *baccalarius*. The same term was applied to male or female adolescents, squires as well as noblemen, who could not afford their own banner and to low-ranking members of other organizations like guilds or the Church.¹⁰

The main methodological shortcomings of such speculations consist, however, in the absence of any study of possible socio-cultural contexts of the transmission of concepts—like the Arabic one proposed as the origin of ‘baccalaureus’—and analysis of the fundamental cultural differences between the two terms. ‘Bi-ḥaqq al-riwāya’ was a formula within a certificate of audition expressing that the piece of text which was certified had been transmitted by someone (transmitter or author) by oral instruction [see Gacek 2009, 53]. ‘Baccalaureus’ was, in contrast, the title for a young man who had passed his exams at the lowest faculty of the university as well as the *disputatio* and was now permitted to lecture there.¹¹ Again, ‘minbar’ began its life as one of several words for a seat for a ruler or for a judge. Only in the middle of the eighth century does the word seem to have taken on the more limited meaning of a stair leading to a seat for delivering the Friday prayer, the *khutba*. This means it became something that in

⁸ This statement signified that the certified text had been read aloud in the presence of a teacher who was linked to the text’s author in an unbroken chain of transmitters or was the author himself.

⁹ For an example of such a one-sided discussion of the possible origin of ‘baccalaureus’, see Ebied 2003.

¹⁰ <http://peter-hug.ch/lexikon/Baccalaureus>.

¹¹ <http://peter-hug.ch/lexikon/Baccalaureus>.

Christian tradition would be called the pulpit. While teachers used to choose an elevated place to sit on, the sources that I am familiar with do not talk all that much about it and do not call it by a specific name. Hence, I conclude the idea that the professorial chair as a cultural concept was derived from the *minbar*, as *1001 Inventions* claims [70], is not backed by the evidence in hand.¹²

- (5) Caliph al-Maʿmun cannot have written to the king of Sicily nor could this king have sent copies of his manuscripts, since there was no king of Sicily in the third decade of the ninth century [73]. Sicily was part of the Byzantine Empire as of 535 and was ruled by a Byzantine governor. From 827 to 902, the North African Aghlabids held southern Sicily through a governor. Now, the Aghlabids may have sent Byzantine manuscripts to al-Maʿmun, although I do not know of any evidence for this. But their governor certainly was not the king of Sicily; it was only in 902 that the Aghlabids gained almost complete control of the island.
- (6) Concerning al-Maʿmun, the first claim below is an exaggeration and contested in research, while the second is simply wrong:
- (i) al-Maʿmun did not merely steer the House of Wisdom but built an astronomical center in Baghdad [73]. There is no proof in the sources that he directed the House of Wisdom; nor is there any reference in the early sources to anything like an astronomical center. Scholars have taken different positions on whether there was a special building reserved for the purpose of repeated observations.¹³
- (ii) al-Maʿmun established
- many higher institutes, observatories and textile factories. It is said that the number of higher institutes during his reign reached 332. They were packed with students pursuing various subjects in the arts and sciences. [73]

Though I know nothing about textile shops in Baghdad (which is not famed for its production but its import of textiles), I am

¹² http://0-referenceworks.brillonline.com.fama.us.es/entries/encyclopaedia-of-islam-2/minbar-COM_0744?s.num=0&s.f.s2_parent=s.f.book.encyclopaedia-of-islam-2&s.q=minba.

¹³ See, for instance, http://0-referenceworks.brillonline.com.fama.us.es/entries/encyclopaedia-of-islam-2/marsad-SIM_4972?s.num=1&s.f.s2_parent=s.f.book.encyclopaedia-of-islam-2&s.q=observatory.

certain that, according to the available sources, higher institutes of learning did not exist in this period and that the arts and sciences were not studied formally in (classes) packed with students. It is already difficult to find information about anything like a class on a scientific subject beyond the statements about al-Kindi's or Thabit b. Qurra's teaching the one or the other son of their patrons (Caliph al-Mu'tamid in al-Kindi's case, Muhammad b. Musa in the case of Thabit b. Qurra).

- (7) The library of the Umayyad ruler al-Hakam II (reg. 961–976) in Cordoba was not destroyed by crusading invaders but by al-Mansur, the chamberlain of al-Hakam's son Hisham. al-Mansur is said to have dispersed and destroyed in particular the scientific books. It is highly unlikely that the library contained '600,000 Islamic books' whatever the meaning of 'Islamic' here may be [22].¹⁴
- (8) The following is a totally absurd and unfounded claim about the origin of the Indo-Arabic signs for the numbers 1...9:

They (these signs) are believed to have been based on the number of angles each character carries, but the number 7 carries a challenge, as the medial horizontal line crossing the vertical leg is a recent 19th-century development. [86]

The fourth little diagram on page 87 shows 'the numbers 1 to 9 we use today based on the use of angles'. First, we do not write these numbers in the angular fashion shown; second, the diagram above this angular nonsense shows three specimens of written forms of the signs from Arabic manuscripts that plainly contradict the angular hypothesis. The lack of critical discernment of what can or cannot be a reasonable hypothesis is characteristic of many writers for *1001 Inventions* and could not be illustrated more clearly. This third diagram is headed by the claim that 'the Muslims devised modern numerals' which is partially correct and partially an exaggeration. Only very few scribes, as compared to the entire population, participated in producing variant after variant of the nine numerical signs plus the sign for zero. Thus, the definite article is inappropriate in the header.

¹⁴ For a discussion of al-Hakam's library and argument that the number of items expresses awe and is not the result of the librarian's counting of each and every manuscript, see Wasserstein 1990–1991.

As far as the manuscript evidence shows, there is no straightforward, clear progress from one form to other; it took centuries to finalize the forms that we use today in scripts based on the Latin alphabet and those used in scripts based on the Arabic alphabet. These final forms in the first case emerged partly in Arabic and partly in Latin as well as in vernacular texts in North Africa and parts of Europe (mainly the Iberian peninsula, France, England, Italy, Germany).¹⁵

- (9) Fatima al-Fihri [sic]¹⁶ did not found a university but a mosque in Qayrawan [26, 69: cf.8]. Robert Grosseteste did not study in Cordoba [29]. Neither Ibn al-Haytham nor Ibn Khaldun were alumni of the al-Azhar *madrasa* [68]. Ibn Khaldun taught at al-Azhar [68], but Maliki law; he also taught a divinatory art (geomantics). St. Jerome did not write a *History of Ancient Nations* nor was such a work translated into Arabic [70]—the author of this section has copied this from Sibai [1987, 53], who mistakes St. Jerome for Orosius and the latter's *Historiae adversus paganos libri septem* (fifth century AD) for the *History*. Yuhanna b. al-Bitriq did not translate a Latin translation of Aristotle's *Historia animalium* (not 'Book of Animals') into Arabic but a Greek version [72–73]. al-Jahiz did not live in the eighth but in the ninth century [77]. Gerbert of Aurillac did not study at Cordoba and then return to Rome [86–87]. The Ottomans did not 'develop' Kufic style nor Naskhi calligraphy [102]: both came into being many centuries before, as correctly stated a page earlier [101].
- (10) The armies of Aragonese, Castilian, and other local Christian rulers from the north of the Iberian Peninsula, which often also included Muslim forces due to various alliances between rulers of different faiths, are not called 'crusaders' [22]. This term is usually reserved for Catholic invaders in Egypt, Syria, Palestine, and Byzantium. Sicily was lost to Muslim rulers centuries before the Iberian peninsula came fully under Catholic rule and Timur conquered Iran and parts of Central Asia. 'The Muslim world' did not 'suffer the onslaught of Timur' as a 'foreign' invader like the crusaders and the Mongols, as implied in *1001 Inventions*' effort to explain what its editors term 'the coming to an end of such an enlightened era' [22]. Timur was

¹⁵ For the sake of brevity I use modern geographical labels.

¹⁶ This has to be 'al-Fihriyya'.

raised as a Muslim; he was a tribal upstart who sought to carve out a territory to rule and plunder like many other Muslims who conquered various parts and pieces of Asia, Africa, or Europe [22].

- (11) Robert Boyle, John Wallis, or Johannes Hevelius did not translate Arabic manuscripts [23]. Their interests in mathematical, astronomical, and other manuscripts in Arabic or Persian were often limited to very special issues like the parallel postulate or observational data. They were neither the first nor the only scholars during the 16th and 17th centuries who asked their colleagues for help regarding such texts, who corresponded with the Royal Society about potential projects of translation, or who wrote lists of questions about nature, commerce, culture, and so on, for merchants visiting foreign lands, in particular China, India, the so-called Spice Islands, or the Ottoman Empire. The editors of *1001 Inventions* present these bits of historical knowledge as if they were the first to discover them, not acknowledging anywhere the academics who researched and wrote about them long before al-Hassani and his collaborators started dabbling in history [23]. It is not true that the Latin translations from Arabic to Latin made in the 12th and 13th centuries ‘fed the scientific and philosophical revolution of the 1600s and kept the flame of knowledge alive’ [23], although it is true, in my and some of my colleagues’ understanding of the intellectual activities in Catholic and Protestant countries, that several of those translations were among the resources that scholars drew upon during those two centuries, some defending their academic traditions and others taking them apart [see, e.g., Russell 1994].
- (12) The ‘Muslim world’ did not ‘stretch for more than a 1000 years from the seventh century onward from southern Spain as far as China’ [24]; the last Islamicate society on the Iberian peninsula was conquered by Catholic troops in 1492.
- (13) Caliph ʿUmar (reg. 634–644) did not govern with ministers, let alone with a female health and safety minister [23]; Jabir b. Hayyan is not considered the ‘father of chemistry’ except by amateurs [23]; al-Razi was not the ‘father of clinical and experimental medicine’ [24]; Lubna (not Labna) was not a mathematician and scientist but is said to have known some arithmetic, probably as part of her training as scribe or secretary of the Umayyad Caliph al-Hakam (not Hakim).

- (14) The image of a windmill [23] does not show a medieval specimen; the painting of Cordoba does not portray the city in its Islamic period, but in the 18th or early 19th century [23].
- (15) The first reference to chess in a Latin source is not by Countess Ermessind of Barcelona in 1058 but by Count Ermengaud I of Urgel (today Spain) in 1008. The diagram in a copy of *Muntakhab*¹⁷ *Kitab al-shatranj* is not a miniature; and though the text itself is ascribed to al-Suli, it is more likely the work of a later person since the title of the book, which al-Suli apparently wrote together with a physician from Sarakhs, is simply *Kitab al-shatranj*. This work is described as a manual either on problems and openings or on openings alone; hence, it seems to be unlikely that it is a collection of chess games that were played by correspondence, which according to the caption is considered by scholars a possibility. Since this general, anonymous reference to scholars is missing in the second edition, I do not trust it here: it would have been more convincing if some specific evidence had been added that chess was indeed played at long distance. The text on chess is imprecise in its formulations suggesting for instance that ‘Arabs’ brought chess from the ‘Persian court’, meaning the Sasanian dynasty, to ‘medieval Spain’ without indicating the many centuries separating them—the reader is invited to believe that the ‘Persians’ and the ‘Arabs’ in this presentation were contemporaries. The text is confused when naming important chess players at the Abbasid court in Baghdad, ignoring one of the most famous of them, namely, al-ʿAdli, and giving a name that I could not find in Ibn al-Nadim’s list, i.e., al-Aadani [*sic*]—which certainly is misspelled—and mistaking Ibn al-Nadim, the author of the list, for a leading chess player. The sequence of the two first names, i.e., al-Suli and al-Razi, reverses the order of their lifetime, with Suli having been born in about 845 when Razi was already at the height of his success. Both players (or their ancestors) came from Iran; thus, the chance that they were among the ‘Arabs’ who brought chess from the ‘Persian’ court is slim. The name of the Russian grandmaster Averbakh is misspelled as ‘Averbak’. That he appropriated an opening from al-Suli without saying so, as suggested by the text, is probably another

¹⁷ This is misspelled as ‘Muntahab’ on page 47.

overstatement; at least, the biographical notes about Averbakh on the Internet mention his study of and his high appreciation for al-Suli's descriptions of chess games. The title of the book produced in 1283 for Alfonso X is 'Libros de ajedrez, dados y tablas' ('Books of Chess, Dices, and Boards').

- (16) Many of the early buildings have not survived the vicissitudes of time and, thus, we cannot say as *1001 Inventions* does that '(l)ike many Muslim buildings, schools were constructed with no expense spared, and beauty was an important consideration' [65–66]. There were certainly many beautiful, spacious *madrasas* built by wealthy rulers, their wives, daughters, relatives, and officials which we still can admire today in Cairo, Damascus, Sivas, Erzerum, Istanbul, Isfahan, or Samarqand, to give only a few well known examples. But many *madrasas*, not to speak of the *kuttab*, were houses donated as a *waqf* by their previous owners and, depending on the individual wealth, taste, and status of these donors, could have all sorts of sizes, sumptuousness, and decorations. Many small *qubbas* with one or two tiny rooms can be seen when traveling through North Africa, for instance. Except for some of the dynasties, among them the Almohads and the Ottomans, there was no official supervision of teaching and certainly no state office responsible for such an educational policy: individual sultans, shahs, and governors interfered repeatedly in the appointing of teachers for *madrasas* but so did the *madrasa* teachers themselves who manipulated members of the military aristocracy to snatch away a chair that they coveted and whose incumbent they objected to. Things never were or are that easy, straightforward, orderly, and glorious as *1001 Inventions* portrays.

There are many more errors, exaggerations, simplifications, and inventions to be found in the third edition of *1001 Inventions*, more than I care to report. I am certain that those I have listed and their variety of types will make clear that *1001 Inventions* is unreliable, disastrous, and, as I know from my experiences in class rooms, dangerous. Even academics have fallen for this glamorous, superficial, heavily distorting fabrication of a further variant of Muslim-centric history of science. Some of them have actually contributed actively to its tales.

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