

## **NST Part IB History and Philosophy of Science**

### **Senior Examiner's Report**

**17 June 2014**

#### **1. The examination process**

As in previous years, the Part IB HPS examination consisted of two papers: History of Science (HPS/1), and Philosophy of Science (HPS/2). The examiners were Dr Adrian Boutel, Prof. Hasok Chang (senior examiner), Dr Helen Curry, Dr Marina Frasca-Spada, Dr Nick Hopwood, and Prof. Simon Schaffer. There was no external examiner.

Drs Curry, Hopwood and Schaffer read the History of Science scripts, and Drs Boutel, Chang and Frasca-Spada read the Philosophy of Science scripts. Each script was blind double-marked. On each paper, any given examiner read 2/3 of the scripts, the rota being arranged so that each pairing of examiners was assigned 1/3 of the whole set. A numerical mark out of 100 was given by each examiner to each script as a whole, and that mark was agreed between the two examiners in each case. Marks were not agreed question-by-question, though each examiner did make assessments of each answer, in his/her own way.

Examiners were asked to be mindful of the new scaling regime in NST Part IB this year, requiring the following distribution (unless an exemption is warranted by the 'cohort values' reflecting the group's performance level at Part IA): 20% of candidates in each subject to receive firsts in that subject, 40% to receive 2.1, and the remaining 40% to receive 2.2 or below.

The History of Science exam took place on Monday 2 June 2014, and Philosophy of Science on Tuesday 3 June. The subject examiners' meeting was held on Tuesday 10 June, to agree all marks and discuss any issues. The examiners are to be commended for working to this tight timetable. The schedule was made slightly more challenging by the fact that 4 of the HPS/2 scripts were not delivered till Friday 6 June, and only upon urgent inquiry; senior examiners in future years should be more alert to the possibility of such delay.

There were no notable incidents during the examinations, to the examiners' best knowledge. All candidates with registered disabilities were accommodated appropriately, to the best of our knowledge. One candidate withdrew from both exams; one candidate answered only one question on each paper; the examiners were not made aware of the circumstances of either candidate.

Most examiners reported difficulties in deciphering the poor handwriting of some candidates, for which inordinate amounts of examiners' time and effort were spent. This is a recurring problem.

#### **2. The subject examiners' meeting, and recommendations arising from it**

The HPS subject examiners' meeting on 10 June was attended by all examiners. The overall marks were agreed very quickly at the meeting, since the 3 examiners on each paper had met on the previous day to agree marks and there were no outstanding disputes, and the senior examiner had prepared the scaled overall marks before the meeting. The whole meeting lasted for one hour.

The raw agreed marks missed the NST targets for the distribution of classes, producing the required proportion of firsts but too many 2.1's. The cohort values (from Part IA results) were 9.8% (for firsts) and 33.33% (for firsts and upper-seconds). The results were scaled

using the '2 paper only' scaling markbook provided. The scaling process was straightforward, and affected the marks only slightly; the maximum adjustments in overall mark were 2.0 points down at the 2.1/2.2 boundary (62 to 60), and 1.0 up at the 2.1/1st boundary (69 to 70).

It was noted that the raw marks in the first-class range were considerably higher on the History side than on the Philosophy side, which is a new phenomenon this year. Raw marks on HPS/1 went up to 83, but only up to 75 on HPS/2. After a brief discussion it was agreed that we should not attempt to make a *post hoc* attempt to remove this difference. However, future examiners are advised that as much parity as possible should be reached between marks on the two papers, unless there is a perceived difference in overall quality of performance; that was not sufficiently clear this year.

It was noted that this year's questions on HPS/2 were very succinct and therefore pleasing to the examiners, but may not have provided enough guidance to the candidates on how the questions should be tackled. Future examiners are advised to consider this factor in setting questions. However, no problematic ambiguities were detected in this year's questions even in retrospect.

A clear majority of the examiners agreed that there was no pressing need to maintain our instruction to candidates that they should write only one side of the paper. It was agreed that we should omit this instruction in future years, thereby leaving candidates with the University-wide instruction that they should write on both sides of the paper (unless instructed otherwise). It was also suggested that the handling of scripts would be easier if each script came in one bundle, rather than in 4 separate bundles topped by a loose yellow cover sheet.

One examiner questioned the practice of providing the senior examiner with a class list with the names and other details of the candidates, given that the whole process of examination up to the subject examiners' meeting is carried out anonymously.

### 3. Summary of results

There were 59 candidates entered for the examinations, including 2 MIT students and 2 candidates for Part II Physical Sciences. 1 Part IB candidate withdrew from both papers. The statistics given below are only of the 54 NST Part IB candidates, the group for whom the scaling was done.

The distribution of classes, after scaling, was as follows:

70.0 or above (1st)	11 candidates (20.37%)
60.0 to 69.9 (2.1)	22 (40.74%)
50.0 to 59.9 (2.2)	19 (35.19%)
40.0 to 49.9 (3rd)	1 (1.85%)
0 to 39.9 (fail)	1 (1.85%)

The average mark was 61.85, with a standard deviation of 9.44.

Both of the Part II Physical Sciences candidates received overall marks in the upper half of the 2.1 range. The MIT students only took HPS/2; one achieved a mark in the 2.1 range, the other one 2.2.

## Appendix to the NST Part IB HPS Senior Examiner's Report (for the HPS Department)

Hasok Chang

26 June 2014

**1. The overall distribution of the marks** (submitted to the NST Part IB final senior examiners' meeting) is shown in the table below, alongside the results from previous years. Note that the new NST IB-wide rule came into effect in 2013–14, requiring 20% of students to be given firsts, as well as 60% of them above 2.2, unless a different distribution is justified by cohort values based on IA results. Also note that the 2014 figures exclude non-NST IB students (as detailed in the main part of the report).

[Class]	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005
1 (70-100)	<b>11</b> <b>20%</b>	8 14%	15 21%	1 1%	9 13%	15 18%	7 12%	16 27%	13 19%	13 13%
2i (60-69)	<b>22</b> <b>41%</b>	27 47%	27 39%	48 61%	34 48%	37 45%	27 46%	22 37%	29 42%	46 47%
2ii (50-59)	<b>19</b> <b>35%</b>	21 36%	21 30%	29 37%	24 34%	26 32%	25 42%	22 37%	27 39%	35 35%
3 (40-49)	<b>1</b> <b>2%</b>	2 3%	6 9%	1 1%	4 6%	3 4%	0 0%	0 0%	0 0%	4 4%
Fail (0-39)	<b>1</b> <b>2%</b>	0 0%	0 0%	0 0%	0 0%	1 1%	0 0%	0 0%	0 0%	1 1%
Total	<b>54</b>	58	69	79	71	81	59	60	69	99

**2. The distribution of results by gender** has been recorded since 2005 (except 2012):

Class	2014		2013		2011		2010		2009		2008	
	Male	Female	M	F	M	F	M	F	M	F	M	F
<b>1</b>	<b>4</b> <b>17%</b>	<b>7</b> <b>23%</b>	6	2	1 1%	0 0%	5 7%	4 6%	10 12%	5 6%	2 3%	5 9%
<b>2i</b>	<b>10</b> <b>42%</b>	<b>12</b> <b>40%</b>	15	12	26 33%	21 27%	18 25%	15 21%	22 27%	15 19%	11 19%	16 27%
<b>2ii</b>	<b>9</b> <b>38%</b>	<b>10</b> <b>33%</b>	11	10	14 18%	14 18%	15 21%	9 13%	12 15%	13 16%	11 19%	13 22%
<b>3</b>	<b>0</b> <b>0%</b>	<b>1</b> <b>3%</b>	2	0	1 1%	0 0%	0 0%	4 6%	2 2%	1 1%	0 0%	0 0%
<b>Fail</b>	<b>1</b> <b>4%</b>	<b>0</b> <b>0%</b>	0	0	0 0%	0 0%	0 0%	0 0%	0 0%	1 1%	0 0%	0 0%
<b>Total</b>	<b>24</b>	<b>30</b>	34	24	42 53%	35 44%	38 54%	32 45%	46 57%	35 43%	25 42%	34 58%

Note that the percentages given in this year's results mean something different from previous years; they indicate "what percentage of the women students got 1st", etc. This year's distribution gives no cause for concern. It is worth noting that we seem to have returned to the pattern shown in 2008, when female candidates were both

more numerous and more high-performing than male candidates. This is in fairly clear contrast to the 2009, 2010, 2011 and 2013 results.

**3. As in previous years, we monitored the uptake rate of different questions on each paper.** Note that one candidate answered only one question, on each paper.

**History of Science** (56 candidates total)

Question	1	2	3	4	5	6	7	8	9	10	11	12
No. of answers	20	35	9	27	11	4	30	15	15	12	35	8

On the History side, there was some significant bunching in Section B, though not to a worrying extent; Q4 (Big Science), Q7 (science of disease) and Q11 (scientific revolution) were very popular, perhaps not surprisingly. The uptake was disappointing on Q3 (molecules in biology and medicine), Q6 (industrialisation) and Q12 (gender in medicine).

**Philosophy of Science** (58 candidates total)

Question	1	2	3	4	5	6	7	8	9	10	11	12
No. of answers	29	28	16	44	8	7	20	17	11	19	22	5

On Philosophy, Popper and Kuhn were clearly popular topics; not only did most candidates answer Q4, which was specifically on a comparison of their views, but there was also a tendency to answer either of the Section A questions on the basis of that material (which was not a plausible strategy, as Q1 and Q2 were not really about Popper and Kuhn). This year there was a healthy uptake on questions concerning the philosophy of the various specific sciences (Q8, Q9, Q10). On the other hand, the uptake on Q5 and Q12 was unexpectedly low. Concerning Q12, it could be that most of the candidates interested in the material from the “Ethics in Science” course answered Q3 and did not feel up to tackling another question from it. The case of Q5 (*ad hoc* hypotheses) may be understandable in a similar way, if those who answered Q4 also felt that what they could say about Q5 was also from the Popper and Kuhn material.

**4. General comments on performance, exam-setting, and marking**

This year the Philosophy-side examiners were clearly stingier at the top-end than the History-side examiners. The History examiners are to be commended for their willingness to use the full range of marks. We discussed this issue at the examiners’ meeting, but two of the Philosophy-side examiners reported that they simply felt unable to assign marks beyond the low 70s. In future years it may be helpful to agree upon a more strict marking guideline that aims for parity between the two papers; for this year, having done the initial marking without such a guideline, it was felt that attempting to adjust the raw marks in order to reach parity would have introduced too many other difficulties.

There remain some issues about the extent to which similar or identical material can be used in different answers. On the Philosophy side Q2 and Q8 both invited cross-disciplinary comparisons, and many candidates repeated material on Popper and Kuhn in both sections of the paper.

On the History paper, many candidates found it hard to devote the appropriate amount of space to an answer to the question: either they spent a long time analysing the terms, or else they failed almost entirely to think about the specifics of the question.

On the Philosophy paper, the quality of answers on standard general philosophical issues (induction, causation and confirmation) was not good this year. The answers tended to lack insight, and the more technical aspects were either left out or routinely mistaken.

## **5. Comments on performance on individual questions**

### **Paper 1: History of Science**

#### **SECTION A**

##### **1. 'The histories of the various sciences are more similar than different.' Discuss.**

Perhaps not a clearly phrased question. Candidates had great difficulty with the notion of 'similar histories' of the various sciences, and instead focused more on reductionism, or on institutional factors.

##### **2. What roles have religious beliefs played in the sciences?**

The more popular of the section A questions: most candidates managed to distinguish between religion as resistance to or enabling factor for scientific development, citing Galileo, Newton and Darwin as favoured examples. Little specific analysis of the theme of natural theology, and much more on explicit forms of theism and atheism, with some frequent closing remarks about Dawkins. Very rarely, candidates recalled that Christianity is not the only religion.

#### **SECTION B**

##### **3. How and why did molecules come to play such prominent roles in the biological and biomedical sciences?**

Not a popular question: overwhelmingly, answers gave detailed accounts of Crick, Watson, Franklin and DNA. Some added the earlier developments in molecular biomedicine; others explored the human genome project and, significantly, the case of sickle cell anaemia. Few seemed able to connect the two aspects of the question.

##### **4. Should we characterise scientific research in the later 20th century as uniquely 'Big'?**

A very popular question. Candidates confused the sense of uniqueness with that of exclusivity. Some attempts were made to identify the origin of the phrase Big Science in the statements of Alvin Weinberg and (less often) the writings of Derek Price. Tycho Brahe was the favoured case to show that large scale inquiry massively predated twentieth century sciences, when candidates spotted the word 'uniquely' in the question; otherwise, the Manhattan project, LHC and HGP were the preferred examples of large scale programmes since the mid twentieth century. The chronological scope of the late twentieth century was not entirely understood.

**5. What was more important for modern physics, the work of Einstein, or the Manhattan Project?**

The comparison between Einstein and Manhattan project generated a few, sometimes impressive, answers. Candidates generally understood the implication of the contrast, but were less confident about the details of Einstein's work and less capable at pursuing the arguments into the aftermath for modern physics.

**6. How did industrialisation shape science before 1900?**

Rarely attempted: the chronological scope of the question was broad and very ill defined, and candidates struggled with notions of 'industrialisation'.

**7. How and why did the science of disease change between the late 18th and the early 20th centuries?**

By some measure the favoured question. Good answers connected institutional and more scientific material. A weak grip on chronology was evident. The phrase 'science of disease' was cunningly inserted in the question, but many candidates took it to be a synonym either for 'disease' or for 'medicine'. Standard moves included evocation of Paris medicine and of the advent of germ theory; several candidates ignored the instruction to cease around the early 1900s.

**8. How did the scientific career develop in France, Britain and the German-speaking lands in the first half of the 19th century?**

This was a very challenging question, but well answered in the main, with almost all candidates making sense of the need for three way comparison, and suitable reflections on the aftermath of the French Revolution. A good discriminator of stronger candidates. German material was certainly the weakest of the cases.

**9. In what ways did exploration and global travel contribute to the transformation of the sciences in the 18th and 19th centuries?**

Banks and Darwin were the favoured cases, with occasional references to longitude. The treatment of the *Beagle* voyage was predictably detailed and extensive, that of the later eighteenth century projects much less so.

**10. How did natural philosophers' understanding of electricity change during the 18th century?**

Rather detailed and chronological answers, in the main, with Gray, Franklin and occasionally Coulomb and Galvani featuring as examples. Not often attempted.

**11. Was there a scientific revolution in 17th-century Europe?**

This attracted many answers, with suitable philosophical reflections on the very notion of a scientific revolution and, occasionally, some historiographic remarks about Butterfield's schema. The consensus was that there were changes insufficiently dramatic to merit the label. Answers were often distressingly digressive.

**12. How did early modern medical practitioners define the differences between men and women?**

Not often answered, and some following discussion of Laqueur, with some fascinating examples drawn from Galenism's aftermaths. There was by no means constant recognition that the question was indeed historiographic.

## Paper 2: Philosophy of Science

### SECTION A

#### **1. What, if anything, makes science a privileged path to knowledge?**

This question was routinely interpreted as having to do with the demarcation criterion. This also led many candidates to assume that the alternatives to science as ‘paths of knowledge’ are either pseudo-science, or religion (rather than the humanities, etc.).

#### **2. Is there one scientific method for all branches of science?**

The examiners’ intention of this question was to elicit comparisons between different sciences, but many candidates instead went for a comparison between the notions of scientific method advanced by Popper and Kuhn, and sometimes Lakatos and Feyerabend.

### SECTION B

#### **3. Who should decide what scientists research?**

This generated many sensible responses considering various sectors of society in a systematic way, but only a small number of candidates engaged with the more theoretical discussions of this question.

#### **4. Does Kuhn or Popper give a more accurate description of science?**

This was a very popular question. In most cases candidates displayed a good command of the material, and many gave cogent views of their own. Sometimes the distinction between descriptive and normative was not handled very clearly. But it is clear that the “What Is Science?” course did engage the attention of students.

#### **5. When, if ever, is it justifiable for scientists to make *ad hoc* hypotheses?**

Both the uptake and the quality were disappointing on this question. Lecturers seem to have failed to convey the basic concept and how it relates to the material that was handled well in answering other questions.

#### **6. How should causation be distinguished from correlation?**

There was an ambiguity in this question, which may not be problematic: some candidates took the question to be about concrete procedures to be used when one needs to infer causality from data, and others took it as about the abstract meaning of causation.

#### **7. Do observations of green emeralds confirm the hypothesis that all emeralds are grue?**

As noted above, answers on this question were generally poor, and technically weak.

#### **8. Are there any differences between social science and natural science?**

There was a pleasing uptake on this question, and many of the answers were good, covering a few different main points. Many candidates also gave their own independent views.

#### **9. What is a gene?**

This was not a highly popular question, but those who answered it tended to do well. There were some answers displaying a high level of scientific sophistication; this is to

be strongly encouraged, but also generated a quandary as to how to assess philosophical quality.

**10. Does Hacking's "experimental realism" give us grounds to trust what modern physics says about unobservable entities?**

There was good uptake on this; the deliberate linking of the material in the "Philosophy of the Physical Sciences" with Hacking's experimental realism (also covered in "What Is Science?") seems to have paid off in this regard. However, answered tended not to be well-informed about the specific content of the physical sciences.

**11. Can induction be justified?**

Quality was disappointing here, similarly as with Q7.

**12. Should social and moral values have a role in the acceptance of scientific hypotheses?**

As noted above, hardly any candidates answered this question.