Trends in European visual science: 1978 – 1997†

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Abstract. European visual science during the past 20 years—with the glaring exception of ophthalmological research—is reflected in the annual programmes of the European Conference on Visual Perception. The number of countries that have participated has increased with time, and the spectrum of topics that have been presented has broadened. The number of multiple-author papers has increased dramatically, as has the number of papers by authors from different institutions and different countries.

1 Introduction
The following is an effort to characterise European visual science over the past 20 years, as reflected in the programmes of the European Conference on Visual Perception. In order to make the overall picture more transparent, some simplifications have been introduced. Papers and posters have been grouped together, for two reasons: some abstract booklets did not differentiate between them; and posters have lost much of the odium that they had when they were first introduced widely some thirty years ago—scientific societies and sponsors are increasingly accepting posters as a legitimate and necessary means of presenting research to the professional audience. A second simplification was to assume that all presentations in the abstract booklets actually took place, since the inability of an author to attend a particular meeting should have no effect on research already completed.

2 History of the early meetings
Strictly speaking, the first meeting was not part of the series, since it was a workshop on sensory and perceptual processes—broadly defined—that was held within the framework of the Tagung experimentell arbeitender Psychologen (TeaP) in Marburg, Germany, in March of 1978. This meeting—which was organised by John Mollon, Ingo Rentschler, Lothar Spillmann, and myself—was called a workshop in order to take it out of the general programme of the larger meeting, so that its presentations would not be scattered throughout the TeaP.

The vision papers were of high quality and were enthusiastically received: in fact, the attendance at some sessions was far greater than the number that had registered for the workshop, showing that listeners had abandoned the TeaP to attend the workshop. This, and the fact that the workshop was conducted in English, clearly gave offence to some of the TeaP organisers, and it was apparent that any future meetings would have to be independent of the TeaP. The workshop also had a more international flavour than the TeaP, because John Mollon promoted it as a joint meeting with the Experimental Psychology Society of Great Britain, and there were speakers from 8 countries. Among the 46 papers there was one invited and two free papers on vestibular mechanisms; one invited and one free paper on hearing; and one invited and no free papers on touch. There were also several posters and demonstrations,

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but they were not included in the programme booklet, and do not enter into this analysis. Since the other senses represented less than 10% of the free papers, they clearly could not make a viable contribution to future meetings, and the participants therefore asked Hans Vos to organise a visual science meeting to take place during the following year.

At Marburg the two invited speakers in vision were Fergus Campbell, who speculated on experiments that Ernst Mach might have performed had he possessed a cathode-ray oscilloscope; and Colin Blakemore, whose theme was the opinions of Plato, Hering, and Helmholtz on the origins of cognitive and sensory skills. If this latter topic sounds curious today, we should remember that those were the days in which developmental electrophysiology of the visual system was at its apogee.

The following year’s meeting, in Nordwijkerhout, Holland, was a considerable success, with participants from 17 countries. There have now been contributions from a total of 37 countries, or 39 if you happen to be from Scotland or Wales. There have been contributions from all Western European countries except Greece, Turkey, Portugal, Romania, and the Irish Republic, and from every inhabited continent but Africa. European contributions, at 76.8% of the total, have consistently dominated the meetings.

3 Number of contributions per meeting

Figure 1 shows the number of countries making contributions, by year. If the first point—Marburg, which was primarily a national meeting—is excluded, the trend is a gentle, fairly steady rise. The dip at 1991 was Vilnius, which rightly or wrongly was perceived by many as risky because of the prevailing political unrest. Meetings have thus far been held in 11 countries, which are listed in recent abstract booklets. (But all incorrectly give Sofia as the location of the 1987 meeting in Bulgaria: in fact, it was Varna.)

![Figure 1. Number of countries making presentations, by year.](image)

The number of countries may be interesting, but it is at best an indirect measure of the strength of these meetings. More significant is the number of contributions per meeting, shown by the lower data set in figure 2. Because of the year-to-year variability in these data, this figure and figures 4 through 7 show three-year moving averages, to render the trends more evident.

The upper data in figure 2 are those of our big brother, the Association for Research in Vision and Ophthalmology. It is commonplace to comment on the spectacular growth of ARVO, but there is in fact little difference between ARVO’s growth and ours: both rose exponentially between 1978 and 1997, with ARVO slightly more rapid, doubling each 7.5 years, while the ECVP needs 8.5 years to achieve the same growth.
I have distinctly mixed feelings about this: it is of course pleasant to see one’s child thrive; but the prospect of it becoming a hyperthyroid monster is unsettling. With scientific meetings, as with businesses, there is generally a size beyond which further growth becomes counterproductive. We have not yet reached this point, and we still have time at these meetings to find friends and colleagues, and to talk and dine with them, which has become difficult at ARVO because of the sheer size of the meeting. But it is sobering to note that we are within a few years of reaching the point at which ARVO found itself 20 years ago—which many people feel is about when it began to lose its effectiveness as a scientific meeting.

4 Which countries have contributed to these meetings?
The total number of papers of the country of the first author is shown in figure 3, for countries with 1% or more of the total. In making this count the political boundaries of Spring 1997 were used; thus, a paper from Yerevan at the 12th meeting (and there was one) was counted as Armenia, rather than the USSR. Similarly, a paper at the same meeting from Vilnius would be counted as Lithuania, since to count Vilnius as USSR in one era and Lithuania in another would artificially inflate the total.

The number of papers as a percentage of the total for some representative countries is shown in figure 4. With the exception of the left-most point, which is somewhat
distorted by Germany dominating the first meeting, Britain has consistently made the most contributions. The peak at 1992 is the result of an unusual number of British papers at the Pisa meeting. Japan’s contribution, in the bottom right-hand panel, shows a remarkable growth in recent years: in 1997, Japan accounted for just over 10% of all contributions. The United States has been well-represented throughout with 10% to 15% of the yearly total. Perhaps the most remarkable change has been Russia, which for the first decade had no contributions. It is said that the 1989 meeting, in Zichron Yaakov, was the first modern visit to Israel by any formal group of scientists from the USSR. During the last 10 years, Russian scientists have contributed about 10% of the total. This is particularly remarkable in view of the extremely difficult conditions under which Russian scientists work at present.

Figure 4. Percentage of total contributions by year, for 10 representative countries.
Contributions from the Netherlands dropped precipitously in the early 1980s and have been in a slow decline ever since. (The rise in the mid-90s is primarily due to the fact that the 1994 meeting was held in the Netherlands.) In 1978 contributions from the Netherlands were 24% of the total; in 1997 only 4%. This is almost certainly a reflection of the deplorable shift in Dutch government funding, away from basic research and into applied research and development. Twenty years ago the Institutes for Perception Research at Soesterberg and Eindhoven were among the world’s leaders in basic visual science; today they are mainly contractors for applied research and development to the military, industry, and government, both within the Netherlands and abroad.

5 Topics presented at the meetings
Because the programmes of some of the early meetings were not arranged by topic, and because different meeting organisers are bound to put similar studies into different categories, there was no alternative other than to go through the 4000-some abstracts and to try to categorise them. This necessarily introduces some subjectivity; but it has the virtue of consistency. If another person were to do the same scoring, there would inevitably be some papers on which there would be disagreements, but I believe that the main categories are obvious enough to receive similar ratings.

Table 1 lists the topics that reached 1% or more of the total in each 5-year period from 1978 to 1997, arranged in order of frequency. Topics that appear in every 5-year period are printed upright; those that did not reach 1% in every 5-year period are shown in italics. The number of topics that reach the 1% level is reduced in later meetings, because the total number of topics increased with time, reducing the proportion available to the more-frequent topics. The same may be seen in figure 5, in which the total number of topics is given, as well as the number representing more than 5% of the total: there has been a steady increase in the total number of categories, with a corresponding gradual drop in those reaching 5%. (And, no, the meetings were scored in random order.)

Table 1. Topics that reached 1% or more, grouped by 5-year periods. The percentage of the total number of contributions is given by the number following the topic. Topics that reached 1% or more in all 5-year periods are printed upright; those that did not reach 1% in all four periods are printed in italics.

| 1978 – 1982 | 1983 – 1987 | 1988 – 1992 | 1993 – 1997 |
|-------------|------------|------------|------------|
| Motion 10   | Modulation sensitivity 9 | Illusions 7 | Binocular & stereo 6 |
| Neurophysiology 6 | Peripheral 5 | Eye movements 5 | Pattern recognition 5 |
| Clinical 3 | Masking & facilitation 3 | Contrast sensitivity 3 | Models 2 |
| Development 2 | Depth perception 2 | Visual efficiency 1 | Aftereffects 1 |
| Colour 6 | Brightness 3 | Contrast sensitivity 1 | Deprivation 1 |
| Orientation 3 | Luminosity, brightness 3 | Orientation 3 | Receptors 1 |
| Texture 3 | Orientation 3 | Learning & memory 3 | Contrast sensitivity 1 |
| Learning & memory 5 | Luminosity, | Eye movements 4 | Modulation sensitivity 5 |
| Models 9 | Perception 10 | Patterns recognition 9 | Colour 7 |
| Methods 5 | Modulation sensitivity 5 | Illusions 6 | Colour 7 |
| Models 5 | Models 7 | Methods 5 | Models 7 |
| Binocular & stereo 5 | Binocular & stereo 6 | Eye movements 4 | Patterns recognition 5 |
| Perception 5 | Perception 4 | Clinical 4 | Illusions 4 |
| Eye movements 6 | Eye movements 6 | Learning & memory 5 | Orientation 4 |
| Eye movements 6 | Perception 4 | Clinical 4 | Learning & memory 5 |
| Illusions 4 | Patterns recognition 5 | Patterns recognition 5 | Patterns recognition 5 |
| Models 7 | Eye movements 4 | Patterns recognition 5 | Patterns recognition 5 |
| Illusions 4 | Patterns recognition 5 | Patterns recognition 5 | Patterns recognition 5 |
| Development 4 | Patterns recognition 5 | Patterns recognition 5 | Patterns recognition 5 |
| Colour 3 | Development 3 | Texture 3 | Luminosity, |
It is apparent from table 1 that the largest single category has been motion, the proportion of which increased rapidly during the first few years and has since remained fairly steady at slightly over 10%. This may be seen in more detail in figure 6, which shows the variation in the percentage of several topics over time. Motion was scarcely represented in the earliest meetings, but rose rapidly. However, the nature of the experiments that were classified as motion has changed over the years: in the early 1980s it was common to study thresholds for the detection of motion or of changes in velocity, whereas today such topics as optic flow, plaids, motion integration, and structure-from-motion dominate.

The opposite is true of spatial and temporal modulation sensitivity. During the early years of these meetings visual science was still strongly influenced by the methods introduced by Hendrik de Lange to quantify temporal modulation sensitivity and by Fergus Campbell and John Robson, for spatial modulation sensitivity, both of which are topics that appear to have been largely exhausted in the interim. Visual learning and memory show a fairly steady increase over the years. Modelling increased during the early years but has now fallen back. The surge in modelling near the middle of the period is, of course, a reflection of the enthusiasm within the vision community as a whole a decade ago for neural networks and similar methods, and in particular for parallel distributed processing. Other conventional topics, such as eye movements and colour, have remained fairly steady over two decades. Perception, a polymorphous category that might be described as higher mental processes other than learning and memory, has prospered with time.

6 The demographics of publishing

Figure 7 shows the mean number of authors per contribution. The trend toward multiple authorship is clearly upward: in 1978, 60% of the vision papers were single-author; in 1997 the corresponding figure was 24%, and both 2-author and 3-author papers outnumbered single-author papers.

A facile explanation for this would be that senior authors are increasingly buying off their research assistants by making them coauthors. However, figure 8 shows that this is not the case: not only has the number of multiple-author contributions increased, but the number of contributions involving two or more institutions has increased almost 7-fold, as has the proportion of contributions involving more than one country. (Here, data from 1979 were used as baseline, since that was the first explicitly international meeting, and thus the first in which it is legitimate to count the papers with authors from more than one country.)

It has been reported that the number of internationally authored papers peaked in 1992 or 1993, depending on the country being studied, and has since declined (Macilwain 1996). This is not the case for the ECVP: in 1992, 8.8% were internationally authored;
Figure 6. Percentage of total contributions by year, for 10 representative topics.

Figure 7. Mean number of authors per paper, by year.
in 1997, 11.4%. The rate of increase of internationally authored papers has also been more rapid in the ECVP than in science in general: across the board, the number of internationally authored papers approximately doubled between 1981 and 1994; whereas during the same period the ECVP increased 4.3-fold. This should confer an advantage on these authors, since Cuénod (1999) has reported that papers resulting from international cooperation are quoted on average 2 to 3 times more frequently than are publications with authors from a single country.

It is pleasant to speculate that these meetings, which started on a very modest basis in 1978, have contributed to increasing cooperation among scientists within our small speciality, and that they will continue to do so in the future.

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