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Editorial

Are conservation biologists working too hard?

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ABSTRACT

The quintessential scientist is exceedingly hardworking and antisocial, and one who would spend countless evenings and weekends buried under her/his microscopes and manuscripts. In an attempt to bust this popular myth, we analyzed the work habits of conservation biologists using data from *Biological Conservation*'s online manuscript submission system, which includes more than 10,000 manuscript submissions and almost 15,000 reviews from between 2004 and 2012. We found that 11% of new manuscripts and 12% of manuscript reviews were submitted on weekends. Weekend submission rates increased by 5% and 6% for new manuscripts and reviews respectively per year during the study period. Chinese and Indian biologists worked the most on weekends compared to their colleagues elsewhere, submitting 19% of their manuscripts on Saturdays and Sundays. At the other end of the spectrum, Belgians and Norwegians submitted only 4% of manuscripts on weekends. Czech and Polish biologists were the most assiduous weekend reviewers, submitting 27% and 25% of reviews on weekends, respectively. Irish and Belgian reviewers worked the least on weekends, submitting only 6% of reviews during that time. Sixteen percent of new manuscripts were submitted on weekdays after regular office hours – between 19:00 pm and 07:00 am – with the highest rate of nighttime submissions by Japanese (30%), Mexican (26%) and Brazilian (22%) scientists. Finnish, South African and Swiss researchers, however, submitted only 9%, 10%, and 10% of new manuscripts after regular working hours. In general, our results suggest that conservation biologists work extensively on weekends and at night, that the trend for working on weekends is increasing over time, and that these patterns have strong geographical structure. These habits could have negative impacts on the quality of the work as well as on the life-work balance of conservation scientists. Universities and other scientific organizations should allocate more time during regular work hours for scientists to complete their research duties, including the submission and review of manuscripts.

1. Introduction

Scientists have busy schedules. Their workloads are steadily increasing with the institutional demands of administration, teaching, mentoring, grant writing and publishing (Mamiseishvili and Rosser, 2010). By the late 1990s, university professors in the United States averaged 53–55 working hours per week (Jacobs, 2004), requiring work to be completed after regular office hours and during the weekends (Cabanac and Hartley, 2013; Ladle et al., 2007; Wang et al., 2012). Although the majority of US scientists at universities and other research institutions enjoy their jobs (Jacobs and Winslow, 2004), many report being dissatisfied with their workloads, particularly in terms of teaching and administration (Mamiseishvili and Rosser, 2010; Fox et al., 2011). Scientific journals are also impacted by busy researchers who are becoming increasingly unwilling to review manuscripts (Baveye and Trevors, 2011).

Scientists from different countries may have developed varied work habits to cope with these increasing workloads. Citizens of one country might be perceived to be more diligent than those of another, and this perception can give rise to national stereotypes. These perceptions, however, are largely anecdotal and subjective; as far as we know, there have been few studies comparing the work habits of scientists from different countries (but see Wang et al., 2012; Ladle et al., 2012).

The purpose of this study is to determine whether conservation biologists (authors and reviewers) have a tendency to work on weekends and at night (overtime), whether this tendency differs among researchers from different countries, and whether there is any trend of biologists clocking more overtime now than they did in the past.

2. Methods

To investigate the work habits of conservation biologists, we obtained data on: (i) the day and time of submission of 10,512

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manuscripts; and (ii) the day of completion of 14,918 reviews, all submitted to the journal Biological Conservation from 2004 to 2012. Unfortunately the time of completion of reviews was not available and thus could not be included in this study. The dates and times of submission were normalized to the location from where the author or reviewer made the submission. This database also includes the country of the host institution and, in some cases, the academic standing of the authors ($N = 3130$) and reviewers ($N = 3347$).

We used chi-squared tests of association and generalized linear models (GLM) to determine whether authors and reviewers were more or less likely to submit papers and reviews over a weekend than during the traditional workweek. The days that compose the weekend and its duration vary among countries. Here we considered weekend as the part of the working week legally devoted to rest in each country. In most countries, weekend refers to Saturday and Sunday but exceptions to this model include countries such as Saudi Arabia (Thursday and Friday), Egypt (Friday and Saturday), Brunei (Friday and Sunday), and Nepal (only Saturday). We also accounted for countries that have changed their legal working week during the study period (e.g. Hong Kong had a six-day working week until 2006; see the Supplementary Material For Details).

We performed the same analysis to compare paper submissions between two time periods on weekdays: during regular office hours (07:00 to 19:00 h, or 7:00 am to 7:00 pm) and after regular office hours (19:00 to 07:00 h, or 7:00 pm to 7:00 am; as mentioned earlier, the time of submission of reviews could not be analyzed because we did not have the data). We further analyzed these patterns at the country level for countries with at least 50 manuscript or review submissions. In cases where data were available, we also analyzed submission patterns among authors and reviewers at different career stages or academic ranks: postgraduate student, postdoctoral, assistant professor, associate professor, and full professor.

We describe our statistical methods in detail in the Supplementary Material.

3. Results

3.1. Weekend submission of papers

The rate of manuscript submission on weekends (11%) was much lower than on weekdays (89%; $\chi^2 = 10.81$, df = 1, $N = 10{,}507$, $P = 0.001$; Fig. 1a); if authors were submitting papers equally on all days of the week, we would expect 28.6% of submissions (2/7) on weekends (after excluding the five manuscripts from Nepal, the only country with submissions in which the weekend is just one day a week). Authors were in fact submitting less than a third as many papers on an average weekend day as on an average weekday. Many countries, including the United States, the United Kingdom, and Italy had around 9–11% submissions on weekends. Within the study period there was a gradual increase of ca. 5% per year in the rate of manuscripts submitted on weekends (df = 1, Δ Deviance = 17.03, $N = 9{,}667$; $P < 0.001$). There were also differences among countries (df = 27, Δ Deviance = 100.47, $N = 9{,}667$; $P < 0.001$; Fig. 2a) and an interaction between year and country (df = 27, Δ Deviance = 42.02, $N = 9{,}667$; $P = 0.03$). By nation, the highest rates of submission on weekends were found in China (19%), India (19%), Israel (16%), and Poland (13%); and the lowest rates were found in Belgium (4%), Norway (4%), and Argentina (6%; Fig. 2a). The interaction between year and country mentioned above is likely due to certain countries in which the rate of weekend submission is high, such as China, increasing over time in their proportion of total submissions. The academic position (df = 4, Δ Deviance = 3.81, $N = 3{,}130$; $P = 0.43$) of the submitting author did not have any effect on the rate of manuscript submissions on weekends.

3.2. Weekend review of papers

Reviews were also less likely to be submitted on weekends (12%) than on weekdays (88%; $\chi^2 = 18.11$, df = 1, $N = 14{,}914$, $P < 0.001$; Fig. 1b); this again assumes that 28.6% of reviews would be submitted on weekends. Reviews are increasingly likely to be submitted on weekends (df = 1, Δ Deviance = 26.41, $N = 13{,}783$; $P < 0.001$), with about a 6% increase per year in the number of submissions. There are differences among countries in the percent of weekend reviews (df = 29, Δ Deviance = 115.60, $N = 13{,}754$; $P < 0.001$), and there is an interaction between years and countries for the reasons postulated above (df = 29, Δ Deviance = 45.15, $N = 13{,}725$; $P = 0.028$). The highest rates of reviews submitted on weekends were found in the Czech Republic (27%), Poland (25%), Singapore (25%), and China (25%; Fig. 2b), which are close to what the rate would be if scientists in these countries were working equally on every day of the week. The lowest rates of submission were found in European countries

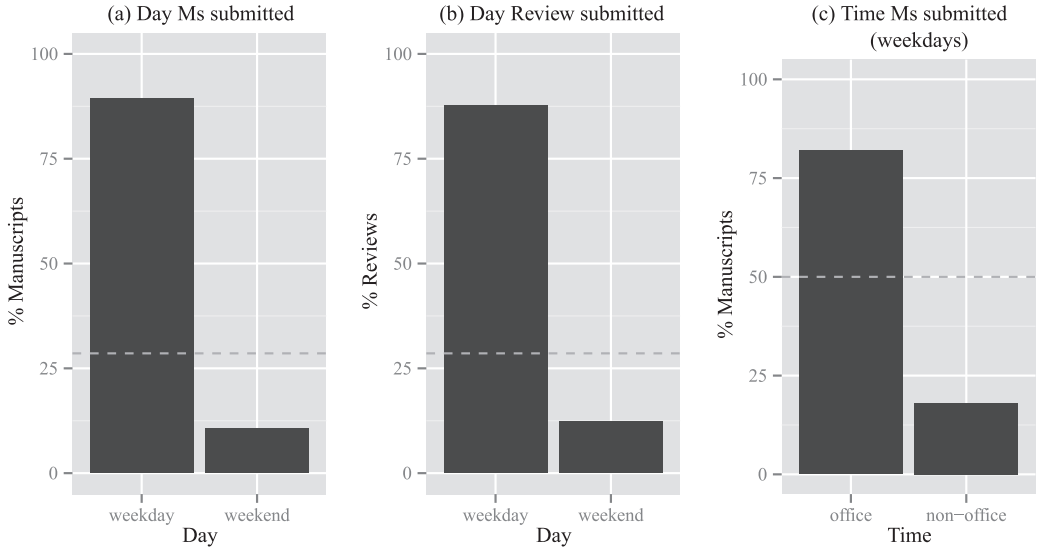

Fig. 1. Work habits of scientists contributing to *Biological Conservation*: distribution of (a) manuscript and (b) review submissions by day of the week; and (c) manuscript submissions by time of the day (including only manuscripts submitted on weekdays). Horizontal dashed lines represent the expected frequency of weekend and nighttime submissions used in chi-squared tests.

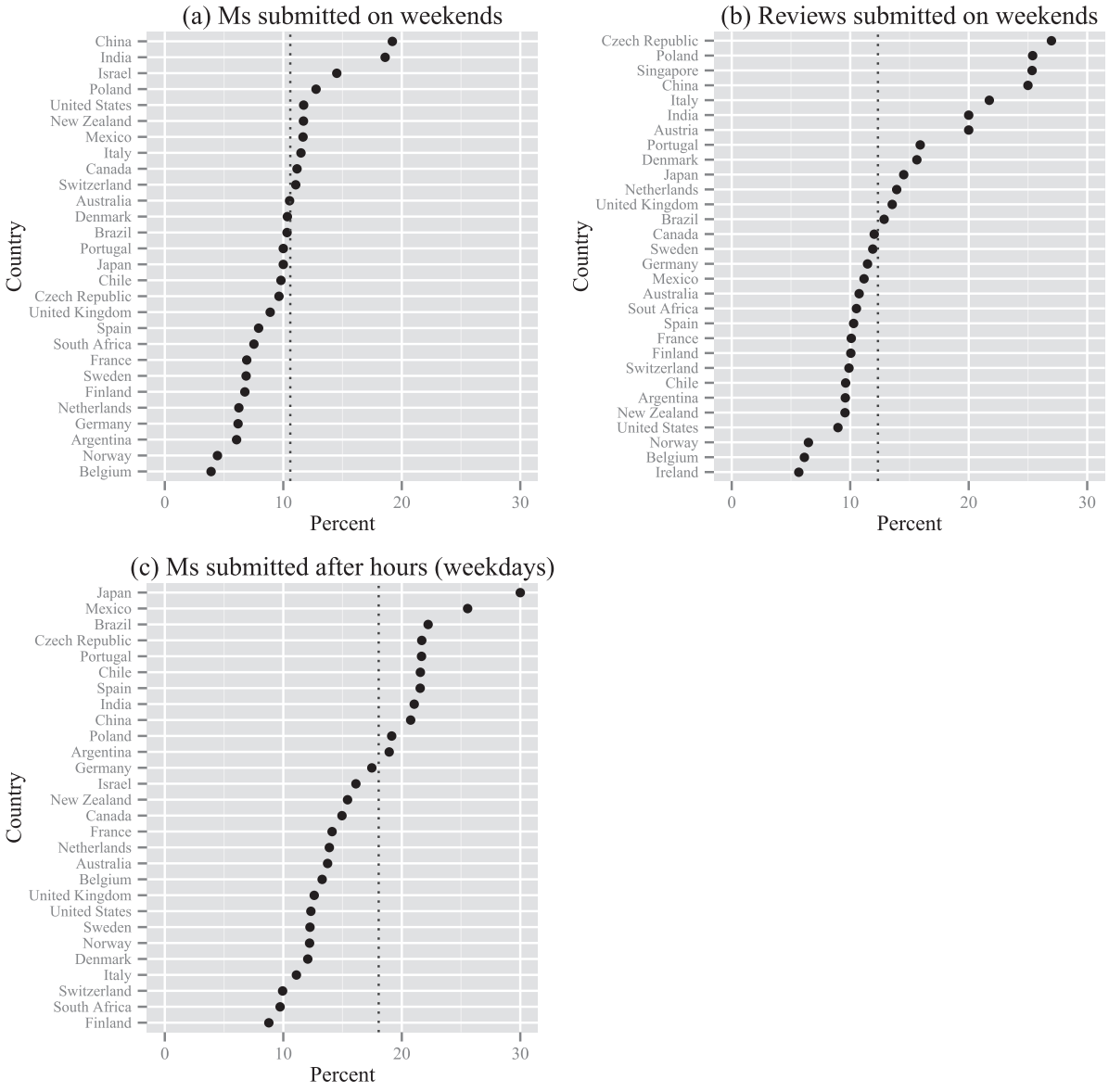

Fig. 2. Distribution of manuscript and review submissions by country of the submitting author or reviewer: percentage of (a) manuscript and (b) review submissions on weekends and (c) manuscript submissions on weekdays outside working hours by authors. Data refers only to countries for which there are at least 50 submissions. Vertical dotted lines represent great mean values.

such as Ireland (6%), Belgium (6%), and the United Kingdom (9%; Fig. 2b). Weekend submission of manuscripts and reviews by country were correlated (Spearman's rho = 0.41, $P = 0.037$). Academic rank affected the tendency to submit reviews on weekends, with full professors showing the highest and associate professors the lowest rates of submissions on weekends (df = 4, Δ Deviance = 9.97, $N = 3{,}342$; $P = 0.041$).

3.3. Working at night

On weekdays, the percentage of manuscripts submitted at night was smaller (18%) than within daytime office hours (82%; $\chi^2 = 3788.65$, df = 1, $N = 9{,}241$, $P < 0.001$; Fig. 1c). If scientists were submitting their manuscripts as part of their 'standard work' we would expect submissions to take place predominantly during office hours (7:00 am to 7:00 pm) – which is only partially the case. The rate of evening manuscript submission varied among countries (df = 27, Δ Deviance = 163.106, $N = 8{,}530$; $P < 0.001$) but did not change over time (df = 1, Δ Deviance = 1.96, $N = 8{,}530$; $P = 0.16$). The highest rates of submissions outside office hours were in Japan (30%), Mexico (26%), and Brazil (22%); and the lowest rates were in Finland (9%), South Africa (10%), and Switzerland (10%; Fig. 2c). Lower-than-average rates were also found for the United States, the United Kingdom and Italy. There was no correlation (Spearman's rho = 0.19, $P = 0.32$) between the submission of manuscripts on weekends and on weekdays overtime in a country. The rate of manuscript submission outside office hours was not affected by the academic position (df = 4, Δ Deviance = 1.97, $N = 2{,}723$; $P = 0.74$) of the submitting author.

4. Discussion

We found that, overall, scientists involved in Biological Conservation's editorial peer-review process do a substantial amount of work on the weekends (11–12% of total submissions) and on weekdays after working hours (16% of the overall manuscript submissions; Fig. 1). Our results are very similar to those for the Journal of the American Society for Information Science and Technology

(JASIST), which found that between 2001 and 2012 the authors submitted 11% of manuscripts on weekends (Cabanac and Hartley, 2013). Altogether, this means that more than one quarter of manuscripts were submitted outside of the standard office hours. These estimates are actually conservative, since we considered a long period of working hours a week (60 h/week) and did not include holidays in our analyses (e.g. Ladle et al., 2007). Against our expectations, the rate of submission on weekends was not higher for manuscripts than for reviews, in spite of the strong incentive for authors (i.e. getting their manuscripts accepted and published) as compared with reviewers (contributing to someone else's work being published). One possible explanation for this pattern is that a review is a 'bite-sized' piece of work that is conducted individually by a researcher, while submitting a manuscript is more complex and generally involves collaboration and communication with several coauthors.

Moreover, the rates of manuscript and review submissions on weekends have been rising 5–6% per year over the past nine years. Our results were again similar to those found with manuscript submissions in JASIST, in which the rate of increase was 3% per year (Cabanac and Hartley, 2013) and reflects the increasing workload reported by scientists (Mamiseishvili and Rosser, 2010).

We also found clear differences in the working habits of scientists in different countries. For example, authors from China and India showed remarkably high rates of manuscript submissions on weekends, perhaps reflecting a high pressure to publish papers by academic institutions of both countries (e.g. Qiu, 2010). The rate of review completions on weekends by researchers from China and India was also high, but not as much as in the case of some other countries. Our results coincide with the findings of Wang et al. (2012), who analyzed the rate of downloading of scientific papers by country and found that for a large proportion of Chinese scientists there is no significant difference between weekdays and weekends. On the opposite extreme are many northern and central European countries, where working on weekends was a relatively rare occurrence (Fig. 2). Two authors from Belgium told us that, "I work only exceptionally on weekends," and "weekends are reserved for family and household activities"; authors from China and India reported that, "most scientists work seven days a week," (China) and "I do real work (any thinking or writing) on weekends since my weekdays are taken up by administration and some teaching" (India). Additional factors which need to be evaluated are the desire to be in an air-conditioned office and need to work on weekends when internet connections are more available.

There were also distinctive national patterns in the tendency to work at night; Japanese researchers showed the most extreme behavior, with 30% of manuscripts submitted after work hours. Japanese scientists are known for their unusually long working hours, and many often work in their offices until nearly midnight on a regular basis (Campos-Arceiz, personal observation). Mexican scientists also are particularly active at night, reflecting their status as the country with the highest average work hours (Washington Post, 2011).

Including both weekend and nighttime submissions, authors based in Japan, China, and India submitted approximately 40% of their manuscripts outside of regular work hours, while in countries like Belgium, Norway, Finland, and South Africa, this rate is just 16–17%.

Our results show geographical differences in professional cultures that resemble those of country-level citing practices and suggest a tendency to scientific insularity (Ladle et al., 2012). Part of the explanation for these geographical differences could be attributed to changes in national priorities and targets for scientists. Countries like China or Brazil, for example, have seen an enormous increase in scientific output in the past decade (www.scimagojr.com). This has been partly achieved by systems of incentives for scientists with good publication records. In many cases, however, university job descriptions have not changed, meaning that this new research activity needs to fit around heavy teaching loads and a considerable amount of administration. European and American institutions, on the other hand, might have much more variation in the type of academic jobs available, including many research-oriented positions with lower teaching and administrative responsibilities (R. Ladle, pers. comm.).

The heavy workload of the average scientists could potentially lead to conflicts with the realms of private life, such as shortened time with family and friends and reduced time for rest, hobbies, physical exercise, and other outside activities. The solution to this problem would be for scientific institutions to allow for sufficient time during working hours for scientists to carry out their research activities, including working on papers and reviewing manuscripts. The peer-review of manuscripts, for example, ought to be systematically considered in annual appraisals, promotion applications, and other forms of academic performance evaluation. Scientists in Belgium and other western and northern European countries, for example, are apparently able to carry out their scientific duties without sacrificing their evenings and weekends. In contrast, scientists in China, India, Mexico, and Japan carry out a considerable part of their work activities outside of regular office hours. It is possible that scientists in these countries need to work longer hours to compensate for a greater degree of professional competition, language barriers, or a higher rejection rate of manuscript submissions (Primack et al., 2009). Additionally, the culture of 'publish or perish' has become global in academia, including the internationalization of university staff, bringing researchers from different countries into close working contact, and the increasing use of bibliometric indices (e.g. H index) to assess scientists, institutions, and countries has arguably increased professional competition notably (R. Ladle, pers. comm.).

A major concern that needs to be addressed is whether these heavy workloads have a negative impact upon the quality of the work performed by scientists. First, some emotional and physical detachment from work is known to have positive effects on creativity (de Jonge et al., 2012), a very important quality for the scientific work. And second, having to complete manuscripts and reviews in a hurry is likely to result in a higher rate of trivial and non-trivial errors.

This study highlights the value of quantitative data in dealing with stereotypes of work habits. While many American scientists, the largest group of scientists submitting to *Biological Conservation*, generally think of themselves as very hardworking (Primack, personal observation), their online submission habits (Fig. 2) reveals them to be comparatively average in terms of working overtime and on the weekends. It is important to note that in this study we have assumed that the day and time of online submission of manuscripts and reviews are representative of the working habits of the scientist submitting them, but this might not be the case. For example, Chinese scientists might be working on a paper primarily during the week, but submit papers mainly on the weekends when more internet connections are available.

In summary, this study has shown that conservation biologists, and presumably other scientists as well, carry out a considerable portion of their work activities on weekends and evenings, that the tendency of working on weekends is increasing over time, and that overtime working habits have very distinct geographical patterns. There is a potential for this overtime to have a negative effect on the quality of the work done by the scientists as well as on the balance between work demands and family and personal life. More detailed comparisons of scientists working in some of the countries highlighted in this study could potentially reveal useful strategies or potential pitfalls to deal with the increasing workload of conservation biologists and other scientists.

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Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.biocon.2013.06.029.

References

Baveye, P.C., Trevors, J.T., 2011. How can we encourage peer-reviewing? Water, Air, and Soil Pollution 214, 1–3.

Cabanac, G., Hartley, J., 2013. Issues of work–life balance among JASIST authors and editors. Journal of the American Society for Information Science and Technology. http://dx.doi.org/10.1002/asi.22888.

de Jonge, J., Spoor, E., Sonnentag, S., Dormann, C., van den Tooren, M., 2012. "Take a break?!" Off-job recovery, job demands, and job resources as predictors of health, active learning, and creativity. European Journal of Work and Organizational Psychology 21, 321–348.

Fox, M.F., Fonseca, C., Bao, J., 2011. Work and family conflict in academic science: Patterns and predictors among women and men in research universities. Social Studies of Science 41, 715–735.

Jacobs, J.A., 2004. Presidential address: the faculty time divide. Sociological Forum 19, 3–27.

Jacobs, J.A., Winslow, S.E., 2004. Overworked faculty: job stresses and family demands. The Annals of the American Academy of Political and Social Science 596, 104–129.

Ladle, R.J., Malhado, A.C.M., Todd, P.A., 2007. Come all ye scientists, busy and exhausted. O come ye, O come ye, out of the lab. Nature 450, 1156.

Ladle, R.J., Todd, P.A., Malhado, A.C.M., 2012. Assessing insularity in global science. Scientometrics 93, 745–750.

Mamiseishvili, K., Rosser, V.J., 2010. Examining the relationship between faculty productivity and job satisfaction. Journal of the Professorate 5, 100–132.

Primack, R.B., Ellwood, E., Miller-Rushing, A.J., Marrs, R., Mulligan, A., 2009. Do gender, nationality, or academic age affect review decisions? An analysis of submissions to the journal. Biological Conservation. Biological Conservation 142, 2415–2418.

Qiu, P., 2010. Publish or perish in China. Nature 463, 142–143.

Wang, X., Xu, S., Peng, L., Wang, Z., Wang, C., Zhang, C., Wang, X., 2012. Exploring scientists' working timetable: Do scientists often work overtime? Journal of Infometrics 6, 655–660.

Washington Post. 2011. <http://www.washingtonpost.com/world/siesta-what-siesta-mexican-work-longest-hours-in-world/2011/04/27/AF3O0yTF_story.html>.