It seemed like a good idea at the time:
A brief history of Journal of Vision

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The time was 1984. The internet was ten years into the future, but a digital world was busy being born. In scientific labs, computers were becoming commonplace, if still expensive. Large VAX computers shared by many researchers were the norm, but with the release of the Apple II in 1977 and the IBM PC in 1981, personal computers also began to infiltrate the working lives of academics. In 1982, the SMTP standard for email interchange was published, leading to rapid growth in the use of email for informal scientific communications.

To Albert Ahumada and myself, this instant and inexpensive medium seemed perfect for transmission of a more formal sort of scientific communication: the journal article. In 1984, at NASA Ames Research Center where we both worked, we submitted a proposal:

“The objective of this proposal is to investigate the issues involved in creating an on-line or electronic scientific journal (ESJ). The journal would be a computer database structured much like a conventional scientific journal, except that all interaction with the journal, including submission of articles, refereeing of articles, submission of referees comments, proofreading, and reading of the journal would be by way of electronic connections such as phone lines and other networks. The electronic nature of the journal will permit flexible and efficient interaction.” (Complete text of the 1984 proposal in Supplement 1)

The proposal was not funded, but the germ of an idea did not go away. Meanwhile, between 1984 and the late 1990’s, the connected digital world exploded. Email became ubiquitous. Established in 1991, the World Wide Web expanded rapidly with the introduction of the Mosaic web browser in 1993, followed by Netscape Navigator in 1994. Once restricted to scientific and other non-profit applications, commercial use of the internet grew rapidly after 1995. The idea of electronic publishing of scientific journals was also emerging (Boyce & Dalterio, 1996).

Living as I did in Silicon Valley, saturated in a potent brew of technical magic and internet euphoria, my thoughts returned frequently to the idea of an internet journal. I spoke about it with many colleagues, all of whom were enthusiastic but who also cautioned about the difficulty of launching such a venture. The main challenge, to which I will return below, was not the technical one of putting digital articles on the web, but the human challenge of convincing authors to gamble their precious work on our untested experiment. Suppressing these doubts, I concentrated on clarifying the principles of such a journal.

By the time these ideas had matured to the form of a clear proposal, they consisted of just three essentials. The first was that the journal be purely digital. All article content, text, figures, equations, and supplementary materials would be represented in digital form. The second was that access to the journal would be through the internet. And the last was that the journal be open access: all content would be freely available without a subscription to anyone with internet access.

The idea of open access had been growing within the scientific and academic community for some time. Prompted in part by the accelerating cost of journal subscriptions, many scientists began to wonder why they were donating their labor to a commercial venture that then priced its product out of their reach. But a second argument, much more compelling to me, was that restricted access was never in the interest of the author or the reader. In contrast, open access completely eliminated the barriers to access to scientific publications, providing an enormous advantage to both readers and authors. To the reader, the paper was always there, instantly, whenever and wherever they needed it, with no concern for subscriptions, usernames, passwords and the like. For the author, it ensured the widest possible distribution of their work. And the internet made that distribution effectively universal and free. Thus the advent of the internet acted as a catalyst for the synthesis of true open access publishing. These ideas were crystallized in the motto we printed on the back of the first Journal of Vision T-Shirt in April 2001: “Be Free, Be Everywhere, Be Forever.”

Some of the earliest pioneering efforts in open access internet publishing were related to vision science. Molecular Vision was founded, remarkably, in 1995 by Jeffrey Boatright (now an ARVO Trustee). The Digital Journal of Ophthalmology launched in 1997, as did Optics Express,
from the Optical Society of America. Somewhat later, several large open access publishers emerged: Biomed Central in 2000 and the Public Library of Science in 2003.

**Conception**

The time was October 1999. Bettina Beard had organized a wine tasting at the Shark and Rose, a small restaurant in downtown San Jose, California, as a social event for the conference of the Optical Society of America. At a long table, I was seated next to Steve Shevell. As the evening progressed, and the wine flowed, I told Steve about my idea. As it happened, Steve was then on the ARVO Long Range Planning Committee. He urged me to consider ARVO as a home for the journal. It would provide, he thought, a stable foundation and instant credibility, as well as financial backing and publishing experience. We agreed that I would put together a proposal, and he would present it to ARVO. The first full draft of a proposal was ready by November, 1999. It is included in full as Supplement 2. It described what the journal would be, why ARVO was an appropriate home, and what the costs might be. It included a discussion of the advantages of internet publishing and open access. It also proposed a name: *Journal of Vision*.

Steve Shevell broached the subject with David Beebe, President-Elect of ARVO. He was enthusiastic and supportive, but cautioned that getting final approval from ARVO would be a lengthy and possibly difficult process. I also discussed the proposal with Joanne Angle, the longstanding Executive Director of ARVO. Ten years previously, by bringing a spreadsheet to the planning meeting, I had introduced computers to the program-planning process for the ARVO Annual Meeting. This may have given me some technical credibility in Joanne’s eyes, and she became a strong supporter of the journal. It should be noted that at this point in time ARVO was the primary scientific society catering to the authors and readers that *Journal of Vision (JOV)* hoped to serve. The VI Section (Visual Psychophysics and Physiological Optics) was among the largest at ARVO, numbering 1,234 members in 2000. A refined proposal including additional details regarding management and editorial processing, along with a proposed editorial board, was presented to the ARVO Trustees at the Annual Meeting in May 2000. As Shevell was unable to attend, Suzanne McKee presented. Persuaded by Suzanne’s eloquence, or Steve’s groundwork, or the support from Beebe, Angle, and VI Trustee Oliver Braddick, the board approved. A montage of photos from a discussion of the new journal, conducted on the evening of May 5, 2000, is shown in Figure 1.

**Schism**

When the program for the 2000 ARVO Annual Meeting appeared, members of the VI section were alarmed to discover that their allotment of platform sessions had been cut by half. While evidently the result of a poll, the reduction was very unpopular among VI members. This combined with earlier discontents about the move of the meeting from Sarasota to Fort Lauderdale. Discussions were held at the meeting (I attended several with, among others, Ted Adelson, Alan Gilchrist, and Ken Nakayama).
Ken ultimately took the lead in proposing a new meeting for the following year, to be held after ARVO, in Sarasota on the gulf coast of Florida. To be called the Vision Sciences (VSS) meeting, it would serve essentially the same interests as the VI section of ARVO.

This was a potentially calamitous event for our fledgling journal. We had not yet published our first article, and already our likely audience was departing to another meeting. But while parted by this conflict, both ARVO and VSS were eager to maintain good relations. As a step toward harmony, we offered to publish the VSS abstracts as a special issue in the journal, and the offer was accepted. The abstracts of the first VSS meeting were published as part of our first volume. This practice continues to this day, and has been one way in which ARVO has maintained a strong connection with VSS and with the functional vision community. VSS is now the Vision Sciences Society and is a flourishing meeting in Naples, FL, with its membership comprising many of the authors in JOV.

Gestation

With the proposal approved, an informal group of associates (Denis Pelli, Cesar Ramirez, Ted Adelson, Tony Movshon) and I began a furious six-month period of consultation, invention, design, argument, and revision. There were few models to follow, few solutions to purchase, and nearly everything needed to be created from scratch. Of course, for an internet enterprise, the first order of business was to register a domain name. I registered journalofvision.org on August 22, 2000. The next task was to construct a set of guidelines that would determine the operational structure and staffing of the journal. This was finalized and approved on November 4, 2000. Not everything in it was to my liking; for example, in a break from tradition, the Editor-in-Chief was excluded from the ARVO Board of Trustees. This may have been due to concern over the newness of the journal, but this lack of parity persisted until 2008, when the IOVS Editor-in-Chief’s position on the Board was eliminated.

The third task was to create an editorial board. We knew that the credibility of the journal would depend upon the stature of the editors, and credibility was key for this experimental venture. Bootstrapping from a small nucleus of advisors (Steve Shevell, Suzanne McKee, Denis Pelli, Tony Movshon, Michael Morgan), we drew up a list of those we considered the most prominent and respected scientists in our field, filtered by our needs for broad coverage of the field. We realized that not all of these individuals would be willing to gamble their reputation on our risky venture, but if even half agreed, we would have an exceptional start to the board. To our amazement, not a single individual declined. The time, it seemed, was right for the journal.

Joanna Matthews was appointed Managing Editor, and a young and energetic Rachel Necker came on board as Production Editor. With staff, guidelines, and an editorial board in place, the first Call for Papers for the journal was issued on Nov 15, 2000 (Supplement 3). We put up a temporary website with basic information (Figure 2). I created a mailing list to enable communication among editors as they joined the band. Discussions turned to the features and design of the journal. This was a dauntingly large list of topics, all of which required resolution in a terrifyingly short amount of time. The list included: whether to include PDF, HTML, or both versions of each article; design of the PDF version; design of the HTML version; design of the website; user interface to the journal; design of the logo; syntax of the URL; syntax of the DOI (Digital Object Identifier); style of the references; how to include animations and other auxiliary materials; whether and how to paginate articles; whether to have volumes and issues; what types of articles to accept; and how to charge for publication.

While many of these questions were difficult, we were guided by a set of principles that we came to call, courtesy of Robert Shapley, the JOVial style. The essence was minimalism. We wanted a graphic style that abjured ornamentation and clutter, and allowed nothing to get in the way of the articles themselves. We selected a color palette - mainly white, black, and gray, with occasional flourishes of cornflower blue - that would not distract from the content. We agonized endlessly over the layout of the PDF version of the article; a fragment of a mock-up from that effort is shown in Figure 3. The design was frozen on New Year’s Day, 2001.

Simplicity was another design goal. Things should work as you expected them to, and articles should be reachable in as few clicks as possible. These principles also applied to the design of the URL, the permanent link to each
The aperture problem in the context of perception of three-dimensional surfaces by midget ganglion cells

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In your school days most of you read this book made acquaintance with the noble building of Euclid’s geometry, and you remember—perhaps with more respect than love—the magnificence of which you were chased about for uncounted hours by extraneous teachers. By reason of your past experience, you would certainly be apt to dread our whiteboard this afternoon. But perhaps this feeling of profound certainty would leave you immediately if some one were to ask you: “What, then, do you mean by the assertion that these propositions are true?” Let us proceed to give this question a little consideration.

Introduction
Geometry sets out from certain conceptions such as “plane,” “point,” and “straight line,” with which we are able to associate more or less definite ideas, and from certain simple propositions (axioms) which, in virtue of these ideas, we are inclined to accept as “true.” Then, on

article. We decided this should be, for example: http://journalofvision.org/1/2/3/ for volume 1, issue 2, article 3. Naturally, the table of contents of an issue could be reached as http://journalofvision.org/1/2/ and the entire volume as http://journalofvision.org/1/. Our deliberations on these topics are captured in a photo from that time (Figure 4), which shows a table in which we considered various forms for the URL for various types of journal content.

With respect to issues, we decided that articles would be published as soon as ready, but collected into issues, in turn collected into volumes. We rejected a more radical approach of dispensing with volumes and issues, and simply numbering articles, in part as a concession to existing bibliographic conventions. Likewise we included page numbers in the PDF which restarted with each volume, but that convention was later changed (Watson, 2007b).

The business model for the journal assumed that authors would help defray the costs of publication, but the details needed to be worked out. In my original proposal I had suggested charging by the kilobyte, but we eventually settled on a fixed fee of $500 per article. This was the subject of some debate, with some fearing that it would be an obstacle to less well-funded authors. But the counter-argument was that this fee paled in comparison to the costs of conducting and writing up the research, not to mention the costs of color page charges in print journals or the cost of attending a scientific conference to present the results. These arguments were made at greater length in a note included here as Supplement 4.

Additional decisions revolved around the potential feature set for the journal. Which of the following did we want to include: embedded images, embedded movies, embedded tables, embedded figures, in-text citation links, links from references (to articles, or PubMed), embedded equations, a persistent link to each article, search within the journal? We wanted them all. Eventually, by the fall of 2000, many of these decisions coalesced into a template, in Microsoft Word or RTF format, that authors could use to compose their article. With a few modifications, that template has persisted into the present day.

Other critical decisions needed to be made concerning the hosting of the journal and selecting a vendor to handle submissions, online peer review, copy-editing, and composition of the manuscripts. For all these services, we selected ScholarOne, then a relatively new company, headquartered in Charlottesville, Virginia. A contract was signed on December 5, and extensive discussions were held that month to configure their services for JOV. Among the key figures at ScholarOne at that time were: Bruce McClelland, Kathy Grotz (QA and Consulting Manager), Wendy Passerell (Director of Journal Services), Eric Keathley (Director Web Application Development), Taylor

Figure 3. A mock-up of the layout of the PDF version of JOV articles.

Figure 4. Whiteboard in my office at NASA, April 27, 2001.

Figure 5. Visit to ScholarOne, February 2001. Left to right, Del Wood, Rachel Necker, Cindy Fuss, Bill Carden, Bruce McClelland, Taylor Bowen, and Andrew Watson.
Bowen (Director Client Development), Anne Spencer (Senior Editor), Debra Pressman-Gimbel (Project Manager), and William T. Carden, Jr. (President & CEO). Figure 5 shows an early visit to the company.

**Birth**

On the first day of the new millennium, we opened our doors. On January 3, 2001, we received our first submission, by email, from Joshua Solomon. After a few last minute glitches, the online submission site was launched on January 15, 2001. On January 17, two more papers arrived. We were in business.

But we did not yet have a logo. A small thing, perhaps, but freighted with significance in this graphic age. Our vendor supplied a few highly professional drafts that reminded me of commercials for athletic shoes or other happy shiny products. Denis Pelli suggested a competition, but there was no time for that. So we did it ourselves (Denis Pelli, Marialuisa Martelli, and myself). The result, in black white and gray, was itself an expression of the JOVial style, with the less important words in low contrast, and the word VISION large and in high contrast (upper left corner of Figure 6).

In February and March 2001, we sent letters of invitation to over a thousand vision scientists, encouraging them to submit to the new journal. We knew that securing a critical mass of authors and high quality articles was the only way to ensure the success of the journal. In the letter, we listed the key features of the journal:

1. All articles will be accessible forever, by anyone, from anywhere, with no subscription or access fees whatsoever
2. Articles are published within 12 weeks of submission (plus author revision time)
3. Images, color, and movies can be included
4. Source code (e.g. MATLAB files) can be included
5. Data files (e.g. MAT, CSV, XLS, or text files) can be included
6. Interactive demonstrations can be included
7. Published articles will have a permanent URL, which can be linked to and from other articles, web pages, email, etc.
8. Articles will be published in both HTML and PDF formats
9. Bibliographic references will link to abstracts or full text of cited articles
10. An annual archive will be published on CD-ROM or DVD-ROM
11. In-text citations will link to bibliographic references
12. In both HTML and PDF versions, the journal will adhere to production standards of highest quality
13. Readers are notified by email whenever an article of interest is published.

Figure 6. Image of the JOV site as of July 21, 2001, obtained from Internet Archive’s Wayback Machine.
Of these thirteen features, eleven became part of the enduring nature of the journal. But no disc version was ever produced, and while our turn-around time was exceptional, we could not consistently meet the goal of 12 weeks.

Also in March 2001, we issued a Call of Papers for our first Special Issue, on Classification Images, with Guest Editors Miguel Eckstein and Albert Ahumada. Over the next decade, we would publish thirteen special issues. They were an important mechanism in augmenting the quantity and quality of articles in the journal, particularly in the early years.

With articles now in peer review, we needed to finalize a design for the journal itself: the home page, table of contents, and so on. While this process involved a myriad of decisions, two were key. First, we decided to make the home page be the table of contents of the current issue (Figure 6). Again we invoked principles of JOVial style: nothing should get in the way of the articles. We did not want the reader to have to wade (click) through a sea of irrelevant material to reach what they really wanted: the content. This decision was controversial, and remains so. Since articles were published as ready, but grouped into issues, it had the unfortunate aspect of occasionally presenting the reader, upon arrival at the journal, with a table of contents containing a single lonely article.

The second key decision was to include in the table of contents an icon for each article (Figure 1). These were small square images (96 × 96 pixels) expected to illustrate the theme of the article. At first they were static, but we soon allowed animated icons as well. This decision was also controversial. Some members of the editorial board considered the icons distracting or beneath the dignity of a scientific journal. In retrospect, I think they were a remarkably prescient and valuable addition. They were very useful in marketing the journal, in banner ads, in email alerts, in posters, and in presentations, and they gave the journal a lively quality often lacking in academic publications. As authors became more adept at telling their story in a few frames, the sophistication of the icons grew. We now have an amazing collection of these visual precis. Another measure of the value of this innovation is that it has been emulated by many prominent journals, among them *Science, Nature,* and *Vision Research.* The only drawback to this innovation was that at the outset, few authors were adept at creating icons, especially of the animated sort, and so it became for me first a hobby, then a burden. But eventually the art of icon creation became widespread, and the burden eased.

With these and many other decisions made, a site design was complete and ready for the first articles. Peer review and production of the first articles proceeded with the expected number of crises and unanticipated challenges, but by late April they had been met, and on May 1, 2001, at the time of the ARVO annual meeting, the first article was published (Artal, Guirao, Berrio, & Williams, 2001). An introduction describing the features and ambitions of *JOV* was also published (Watson, 2001). Two more articles followed rapidly. An image of the *JOV* site, as it appeared in July 2001, is shown in Figure 6.

We were underway. By August, we had received our 40th submission. Our worst fear, of throwing a party and having nobody come, began to diminish. But the wheels of production were turning slowly. The process of converting the authors’ final materials into a published paper was somewhat chaotic, and responsibilities were unclear. Since our beginning, authors had submitted final manuscripts as Microsoft Word or RTF (Rich Text Format) files. After copy-editing, these were composed in the journal format and rendered into published articles. At that time, the final published product consisted of three main elements: an abstract page (HTML), an article page (HTML), and an article in PDF form. Also produced were the separate image files for the figures, the equations, the movies, and any other auxiliary materials. The PDF was relatively easy to create using Acrobat, but there was no similar tool to create the HTML components. They were created essentially by hand, and keeping them consistent with the PDF through all of the various proofing stages was a (costly) nightmare.

### HyperJOV

In September of 2001 I began to develop software that would automatically convert the RTF file to an HTML file in *JOV* format. This software, called HyperJOV, was built upon a product called R2Net from LogicTran, Inc. In essence, HyperJOV searched the RTF file for our *JOV*-named styles, such as jovHeading1 or jovFigure, extracted the relevant text, figure, or equation, processed it when necessary to produce a GIF image, and then wrapped it in the appropriate HTML code. In principle this was straightforward, but the application code was not particularly simple, as shown in Supplement 5. HyperJOV was completed and went into regular use in December of 2001, and continued to be used until June 2005. This enormously simplified production of HTML and greatly reduced production costs. With this innovation, we also began to do most production of both PDF and HTML in-house, at JOV-West (see below).

### Crisis

By April of 2002, as we approached our first anniversary of publication, we had much to be proud of. We had received our 100th submission and had published our 25th paper. Our first special issue, on classification images, had been completed in March with nine papers. Our rate of submission was climbing steadily, reaching 0.45 papers/day in April.
At the ARVO Annual Meeting in May, I was pulled aside by the Chair of the Publications Committee, who suggested we go somewhere private to talk. I knew that committee had been assessing the early progress of the journal, and I expected some feedback, and possibly some praise. Instead, he informed me that the committee would recommend that the journal be shut down. In their view, the financial trajectory of the journal was unsustainable. Production costs at ScholarOne had been much higher than expected, while revenues from page charges for the fledgling journal were modest. Our balance sheet was not helped by the fact that JOV, unlike its sister journal IOVS, received no designated part of the dues paid by each ARVO member. Ironically, the publications committee included no member of the VI section, or anyone who might be a potential author in JOV.

The fate of the journal would be decided at an evening meeting of the ARVO Trustees. I was to be allowed to speak, and I recall a long wait in the hall outside their meeting room. Most troubling to me in those interminable minutes was the possible breach of trust to the authors who had shown their faith in our journal. Eventually I was allowed in, and my only recollection of my remarks is that I was passionate, and that I suggested that their choice was between saving a few dollars in one year’s budget, or changing the world of vision science publishing.

After I had left the room, the Trustees considered closing or selling the journal, but ultimately formed a subcommittee with the mandate: “In conjunction with the Editor-in-Chief and Publications Consultant provide to the Board by August 15 a JOV business plan that includes charge for access.”

To my editorial board, I expressed my adamant opposition to access charges. Tony Movshon argued that open access didn’t matter, because all reputable scientists can access any journal they want through the subscriptions of their home institution. In response, I conducted a brief study, asking fourteen scientists at a variety of institutions to try to access 28 different journals from both home and office (Watson, 2004). The result is shown in Figure 7. It clearly showed that closed access journals were markedly less accessible.

I was distraught at the prospect of losing open access, and considered resigning. I contemplated remarks, to present at VSS, explaining my decision, especially to authors who had placed their faith in the journal. But Tony Movshon wisely counseled temperance and patience. We sought other means of ensuring the financial stability of the journal. The subcommittee ultimately recommended increases to the publication fee, and a renegotiated arrangement with ScholarOne to limit them to peer-review processing and hosting. Production moved from ScholarOne to JOV-West. The adoption of HyperJOV, mentioned above, reduced production labor and costs. ARVO adopted a new arrangement in which members could allocate a portion of their dues to either IOVS or JOV. In 2003 we secured over $40,000 in grants to support the journal, including $10,000 from the Smith-Kettlewell Eye Research Institute in San Francisco, CA, and $20,000 from NASA to support a special issue on eye movements and perception.

Figure 7. Results of an informal survey of access of 28 journals by 14 scientists.
We also received $3,000 from the Open Society Institute of the Soros Foundation to defray page charges for authors from selected countries. In time, the financial crisis subsided, and no access charges were ever imposed.

However, at the time of the crisis, word of this situation reached the larger vision science community, and there was doubt about our survival. The rate of submissions dropped precipitously, to less than 0.1 article/day (Figure 16). Submissions did not fully recover until four years later, in June 2006, when we received our first Impact Factor, which restored the confidence of the author community.

**JOV-West**

Starting in the fall of 2002 and lasting until June 2005, all production and other technical work was done in California by a group of freelance associates and myself. Though we never called it that at the time, here I will refer to this grouping as JOV-West. Several of the freelancers were what we called “Technical Editors,” responsible for editing the final submitted materials to meet our requirements, checking graphs, and composing and producing the final HTML and PDF published products. Among this talented group were Timothy Null, Katharine Tillman, Ellen Salud, and Sabra Djomehri. In addition to taking part in the production of 147 papers, Ellen subsequently took on a larger role in editing graphics, quality control, and administering the workflow at JOV-West (Figure 8). During this period, under the pressure of time and budget, I may have edited and produced a number of papers myself. Also working at JOV-West was Cesar Ramirez, a brilliant young programmer who ultimately played a key role in the development of the Journal of Vision (Figure 8).

**DataJOV**

Just a few months after the move of production to JOV-West, Cesar Ramirez and I began to discuss a more radical change in the journal. Instead of static HTML pages, the journal content would be transformed into a database. When a reader clicked on a link, the relevant HTML page would be generated on the fly from the database. The advantages of this approach were numerous. No longer would we need to create separate static abstract and article pages, and tables of contents for issues and volumes. No longer would the visual design be frozen; we could change our formatting or graphic design whenever needed, and it would affect both new and old journal content. We could provide multiple views of the same data, and multiple methods of navigation. Searching would be vastly more efficient and flexible. It would enable new programmable features. We had seen the future, and we knew it would work.

Cesar set to work on the system, ultimately called DataJOV. As the code neared completion, we began to consider where it should be hosted. There were two options: a commercial internet service provider or a dedicated server located at ARVO. Ultimately the latter solution was selected, in part because we wanted effectively unlimited storage to accommodate movies, images, and auxiliary files in addition to article text. After extensive testing and simultaneous operation of the original version of JOV, DataJOV was launched on October 15, 2003.

In addition to its other advantages, DataJOV included an integrated mailing list component that could send alerts to subscribers whenever a new article or issue was published. These alerts could include an animated icon. This added to our marketing efforts, discussed below.

DataJOV also obliged us to rethink navigation within the journal. The solution we ultimately arrived at, dubbed the “powerbar,” enabled one to reach any article in three clicks, and served us well during the lifetime of DataJOV. A screen-shot of the DataJOV interface is shown in Figure 9, with the powerbar just below the logo.

DataJOV also provided alternate views of the Table of contents for issues, volumes, or for the entire journal. These views could be text only, icons only, or icons and text. In Figure 10 we show part of the icons-only view for one volume. Clicking on the issue number led to the table of contents for the issue, while clicking on an icon took you to the article.

DataJOV also contained a search engine, designed with the needs of the reader in mind. Because all article components were contained in a database, sophisticated searches could be performed rapidly and accurately. For example, an author could count how many times they had been cited by searching for their name exclusively in article references. Another innovation enabled by DataJOV was “search links.” We documented the syntax of hyperlinks.

so that a hyperlink could be constructed and saved, and pasted elsewhere, to perform complex manipulations of our search engine. To continue with the above example, an author could create a link that located all of the citations of their own work and then embed that link in a webpage of their own.

With the advent of DataJOV and hosting at ARVO, we were also now able to collect complete server access logs, which we could analyze to understand usage of the journal. This topic will be discussed below.

DataJOV was refined, accelerated, and expanded in the following years. RSS feeds of all articles and the most recent ten articles were added. We added the capability of downloading the article citation in standard bibliographic database formats. And in October of 2004, we made a small but significant change to the naming of downloaded PDF articles. Instead of the generic article.pdf, each article now had an informative name, such as Artal-2001-jov-1-1-1.pdf.

A wonderful aspect of this era in JOV’s development was that, because production, hosting, and software development were all conducted in-house, we could innovate with remarkable speed and efficiency. Cesar Ramirez or I might have an idea, and 24 hours later it would be a reality. Likewise, when problems occurred, they could be fixed immediately.

Instructions

Another small enhancement in 2003 was the development of a comprehensive set of instructions. Writing for JOV was somewhat different than writing for a print journal, and we received many questions from potential authors. Our template, introduced earlier, was helpful, but not enough. The instructions document attempted to cover in thirteen pages all aspects of the authoring of a JOV article, from formatting the text, to creation of graphics, movies and icons, to insertion of hyperlinks, formatting of...
At the end of 2003, spurred in part by a report by Morna Conway, a publications consultant, ARVO determined that it needed greater consolidation, clarity and efficiency in the management of its publications. In April of 2004, ARVO hired Karen Schools Colson to serve as Director of Communications and Publications, and shortly thereafter in September, Alice O’Donnell was hired as the third Managing Editor of Journal of Vision (Figure 11). Part of their mission, as I understood it, was to bring greater stability and professionalism to the Journal of Vision. While the journal had thrived as an experiment created by amateurs, it was time to put in place policies and procedures that would ensure its long term success. In general, this meant a conversion from self-publishing to the use of commercial vendors.

The first step in this process occurred in June 2005 when all production moved from JOV-West to SPI...
One of the hurdles to be surmounted in the launch of a journal is to secure indexing by the major bibliographic search services. We imagined this would be straightforward. All of the services require a significant amount of content before they consider an application, so it was not until April 2002 that we applied to Medline (PubMed) for inclusion and not until almost a year later that we were approved. This delay may have been due to our novelty as an internet-only, open access journal. On the other hand, Alice O’Donnell secured indexing at PsychInfo in one week.

ISI (Institute for Scientific Information) began indexing the journal in September of 2003, and the two-year wait for the so-called Impact Factor began. For better or worse, this metric had become the gold standard for assessing the quality of journals, and many researchers, particularly in European Universities, could not submit to journals with low or non-existent values. When it finally arrived in June of 2006, our Impact Factor was 3.469, placing JOV #1 among specialty vision journals, and #5 out of 45 in the ISI category of Ophthalmology. In 2007, it increased to 3.751 and moved up to #4 in the category, and in 2008 it reached 3.791, #3 in the category, besting its sister journal IOVS (#5), and exceeded only by Ophthalmology, the official journal of a society with 32,000 members, and Progress in Retinal and Eye Research, a review journal that published only 26 articles.

The first impact factor, in 2006, was a pivotal event for the journal. Authors who previously might have been reluctant to submit were reassured. We completely recovered from the severe dip in submissions that had resulted from our near-death experience in 2002 (Figure 16).
vision: one could include stimuli, demos, animations, even experiments! And color could be included on every page, with no extra charge. The third advantage was rapid publication, a promise on which we only partly delivered. At the end of 2001 we created a poster of the first complete volume, using the icons as graphic elements. I carried the poster with me to a number of conferences, mounting it in as prominent a position as I could get away with. In a later version, the icons were arranged by brightness so that they produced an image of the volume number. This poster became a tradition, and each year as the number of articles and icons increased, so too did the resolution with which we rendered the volume number (Figure 12).

The icons served our marketing efforts in many ways. With the advent of DataJOV, and its integrated email capability, we began to include animated icons in the emails sent to subscribers to our alerting service. At about that time, Ted Adelson gave me some advice: “Don’t hide your light under a bushel.” I protested that I was afraid my marketing efforts already bordered on the obnoxious. He countered that, to promote the journal, I should go beyond obnoxious (he used different words). It was a sacrifice I was willing to make. In addition to sending alerts to subscribers, we began to send issue alerts with animated icons to the CVNet and VisionList mailing lists as well.

Another marketing innovation using the icons was a banner ad created for each article. The banner was a GIF file, including the (possibly animated) icon, title, authors, and brief citation (Figure 13). The banners were sent to the authors for their use and also posted on the front page of VisionScience.com, a website that served the vision community and that received some 20,000 hits/day. The banner there was linked directly to the author’s article. The purpose of the banners was twofold: marketing the journal, but also marketing the author’s work. Potential authors in JOV would know that their published article would be publicized widely, and to those attracted, it would be freely and instantly available on the Internet. This was in contrast to print journals, where published articles would be silently consigned to little-visited libraries or to the dusty shelves of the dwindling numbers of subscribers.

Figure 12. Posters for each volume created from the icons for that year.

Figure 13. A banner ad for an article in Journal of Vision.
Another early promotional effort was a t-shirt, in cornflower blue, with the journal logo and the legend: “Be free, Be everywhere, Be forever.” A later effort to use t-shirts as a promotional device was less successful, as described in the following section.

**Merchandise**

Forever on the lookout for ways to enhance the visibility of *JOV*, and inspired by then current notions of “viral marketing,” in January 2008 I had a brilliant idea. What if each author could, with the click of a button, create and purchase a t-shirt with their icon on the front, and the full bibliographic citation on the back? A very nerdy form of dress, to be sure, but we all want to promote our work, and to be distinctively attired. I envisioned the ARVO and VSS meetings populated by throngs of mobile advertisements for the journal. Remarkably, I quickly found a site (zazzle.com) that provided all of the infrastructure I required. By uploading the entire corpus of *JOV* icons, and writing a bit of scripting code, I was able to create a marketplace at which you could enter the volume, issue, and article number, select the color and style of your shirt, and instantly preview and purchase your custom product (Figure 14). The site was launched in March, several weeks before the ARVO conference.

But shortly thereafter I received messages of concern from ARVO; financial management, quality control, and brand management needed to be fully vetted. The site was disabled, and though there was some talk of an “official” version, it never came to pass. The few patrons able to purchase their shirts in that brief interval now possess an artifact of great rarity and value. Hope remains that outstanding issues can be resolved and that the *JOV* merchandise will return.

**Recognition**

In the aftermath of the merchandise misadventure, I was asked to attend a small meeting at the approaching ARVO annual conference, with the association president, executive vice president, executive director, and a few trustees. I feared this might be a star-chamber event, to chastise me for excessive creativity, but whatever the original purpose, it morphed into a fascinating discussion of new long-term strategic planning for the journal. That planning ultimately led to a new hosting arrangement for the journal.

But as I approached a possible censure at the meeting, I was fortified by another planned event at the conference. On the evening of Sunday, April 27, 2008, I was presented with the 2008 ARVO Special Recognition Award, whose citation reads: “For his foresight, energy, and dedication in launching and editing ARVO’s first electronic scientific journal, Journal of Vision.” While I was delighted to receive the award (Figure 15), I viewed this as an award to...
the journal itself, and an acknowledgement of its success, and thus an award to all who had worked so hard to bring it to life.

HighWire

Earlier I spoke of efforts to move Journal of Vision to a more stable and enduring platform. While the journal had thrived on innovation, and on the creative efforts of a small number of people, it was also unduly dependent upon that small group of people. If the journal was to meet its promise to “be forever,” it needed to rely less on people and more on institutions. As the result of strategic planning exercises in the summer of 2008, a Request for Proposals was issued to various online journal hosting providers. The proposals were evaluated, and in May 2009, HighWire Press was selected as the future host for the journal. HighWire, based at Stanford University in Palo Alto, California, is a not-for-profit organization offering online hosting services to the scientific and scholarly publishing community. It is host to *Investigative Ophthalmology & Visual Science* (ARVO’s other journal), *Science Magazine*, *Journal of Neuroscience*, and 1450 other journals, books, reference works and other scholarly publications.

The move to HighWire would not simply be a transfer of content, but would instead involve a completely new programming infrastructure and a complete replacement of DataJOV, which had served us well for seven years. While supportive of the move, I was determined that we preserve as much as possible the unique features that were *JOV*. Concerned that these unique features and their technical underpinnings might be neglected, I asked for and received a motion stating, “We the members of the Editorial Board of the *Journal of Vision* request that ARVO ensure that the Editor-in-Chief be fully involved in any technical decisions regarding the transfer of the *Journal of Vision* to a new host.”

When the new site went live in May 2010, it did not go smoothly. Most distressing, the simple, unique URL that we had designed for each article in the journal no longer worked. Other problems emerged, including missing movies and supplementary files. But in time solutions were found, and while not all previous features of DataJOV were preserved, the essential functionality of the journal was restored, and even now improvements are regularly being made. The valley that we crossed proved more treacherous than some expected, but the crossing was made, and the journal can now look forward to a stable and secure future.

Growth

Over the past decade, with seasonal variations and occasional event-related excursions, the journal has grown.
steadily. Four pictures of this growth are shown above. Figure 16 shows the growth in the rate of submissions over the lifetime of the journal. The graph is computed as a 90-day moving average. From an initial rate of less than 1 per week, we grew by spring 2002 to about 3 per week. The threat to our survival in May 2002 suppressed submissions, and though they recovered somewhat in 2003–2005, they grew markedly after we received our first Impact Factor in June 2006. Since then they have continued to grow and are now at a level of about 10 per week.

A second measure of growth is the increase in rate of publication (Figure 17). This is affected not only by rate of submission, but also by efficiencies in peer review and production. The graph, also a 90-day moving average, shows a generally continuous increase, marked by a few peaks and valleys. The dip in late 2005 is associated with the transition to SPI, and the later peaks are often associated with special issues. The current value is around one article per day.

Another measure of growth of the journal is the trend in Internet visits. Note that, apart from sharing among users, all usage of the journal is via Internet access of JOV servers. As noted above, we have collected and analyzed log files extensively since October 2003. From 2003 to 2007, we tracked “sessions” by analyzing log files using the Urchin software tool. In April 2007 we began using Google Analytics, an online utility that maintains its own logs of access to Journal of Vision, to track “visits” to the site. These two measures are somewhat different, but both are good measures of overall usage of the site. In Figure 18 we have stitched together the two sets of records by arbitrarily scaling the early “sessions” data so that it visually links up with the later “visits” data. The figure clearly shows the steady and continuing growth in access of the journal. The current figure is around 2,000 visits per day.

A final graph, with implications for the future, is shown in Figure 19. This shows growth in visits to JOV from mobile devices. The recent arrival of popular smart phones and especially tablets will no doubt have further impact on how we access and consume scientific publications and will, I suspect, further validate the open access model.

Downloads

Web servers typically maintain a record of each transaction they conduct. These records, usually called Web logs, are widely used to analyze usage of websites. When hosting of JOV moved from ScholarOne to DataJOV in October 2003, we began to collect complete Web logs of all access of the journal (unfortunately, we were unable to obtain the prior logs from ScholarOne). These are rather large files; one day of traffic might total 150 MB in uncompressed text. Using various software tools, we analyzed those logs to assess growth in usage of the journal and to report that growth in a semi-annual report on the
status of the journal. Figure 20 shows the inexorable rise in the total number of downloads from the journal from 2004 to 2010, reaching a total of 3.4 million.

I began to realize that authors would be very interested in this information, not just in the aggregate figures, but in data related to their own publications. And readers would be interested in which articles were popular, and thus possibly worthy of further attention. Based on this idea, I began to develop custom software that would analyze the log files. Written in Mathematica, the software first identified requests for PDF articles. It then filtered out requests from robots that scan the Web to index its contents. It grouped all of the requests for a single article, and then attempted to identify, using various proprietary techniques, which requests were from the same user. Only the first request from each user was retained, and we called these “unique downloads.” This allowed us to construct a graph of unique downloads of a single article as a function of time since publication, which we called the “trace” (Figure 21).

I found that these graphs were quite stereotyped in form, consisting of a rapid initial rise, followed by a slower decelerating increase. By fitting a curve to this pattern, I could estimate a useful statistic, which we called the DemandFactor for each article: unique downloads per day within the 1,000 days following publication.

Cesar Ramirez and I then considered how to present this material within DataJOV. The interface we developed consisted of a link alongside each article which led to the download statistics for that article, including the graph and, if available, the DemandFactor. We also created a new page at the journal which allowed one to reach the statistics for any single article or to view tables of rankings. The new features, which we called “Download Reports,” were launched on May 1, 2007 (Watson, 2007a). An example of the last published table of 20 highest DemandFactors is shown in Table 1.

A number of other journals have since adopted similar features. Notable among them is PLoS ONE, which calls their service “Article metrics.” Regrettably, since the move to HighWire, JOV no longer offers this service though we continue to collect Web logs and hope it will be reinstated at a future time.

### Citations

For better or worse, citations are the gold standard in estimating the impact of individual articles. They are also the basis for ranking journals, as we have discussed earlier in the context of the Impact Factor. Following the
introduction of our Download Reports, which counted how many times articles were downloaded, I became curious as to how those numbers related to citation counts. Using data obtained from Scopus, I was able to perform an analysis that showed that total downloads and total citations of Journal of Vision were highly correlated (0.74), but that relative to downloads, citations were delayed by about 2 years and reduced by a factor of about 45 (Watson, 2009). This reaffirmed the value of downloads as an early indicator of article impact.

With the advent of free public citation counting services such as Google Scholar, we are now able to easily count the number of citations of each article in Journal of Vision. The result of this count as of February 2011 is shown in Table 2. Beyond the individual rankings, the table shows the very high number of citations garnered by many JOV articles, another measure of the progress and stature of the journal. This table and the previous one for DemandFactor additionally illustrate some popular topics in the journal.

Here we provide a few statistical snapshots of the Journal of Vision as it approaches its 10th anniversary. In Table 3 we offer a few summary statistics, while in Table 4 we show the international reach of the journal. Though the US is the largest single source of visitors, it comprises only a third of all visits. In Table 5 we show how our visitors reach the Journal of Vision, whether...
directly or by referral from some other site. While many visitors come directly to our site, many more arrive via search engines.

What about the content of Journal of Vision? Though interests have migrated somewhat over the years, the major themes of functional vision research have remained relatively constant. An attempt to depict them graphically is shown in Figure 22. This shows a so-called word cloud, in which the words most commonly used in JOV titles are depicted in a size proportional to their frequency.

Figure 22. A word cloud composed of the most commonly used terms in titles of JOV articles. Figure created with wordle.com.

Why

What made Journal of Vision a success? Without some serious sociological research, I can offer only subjective judgments. I think that our incessant marketing played a role; with email and banner ads, the vision community could hardly avoid regular exposure to the Journal of Vision. I think that the journal’s perceived stability, with ARVO as publisher, also played a role. And I think that vision scientists in particular were attracted to a medium
that allowed them free use of color, graphics and movies. But I think the most critical feature was open access. Authors rapidly began to appreciate the virtue of having their work accessible to the entire world, anytime, anywhere. As we proclaimed on our first t-shirt: “Be free, be everywhere, be forever” (Figure 23).

Coda

This brief history of Journal of Vision is not the only one that could have been written. I have written a personal history, describing the events of which I was a direct participant. Much of the hard work that went into the journal, especially by the staff at ARVO, has not been sufficiently described, but should be acknowledged. In a memoir such as this there is also the risk that I will fail to recognize key participants, as a result of my fragmentary records and memory. To those individuals, I apologize. Of the people I do remember, a number stand out for their contributions. Steve Shevell and Suzanne McKee provided critical early guidance. At ARVO, Joanne Angle and David Beebe were early and stalwart supporters. ARVO Trustees Oliver Braddick, Donald Hood, Frank Werblin, Joel Miller, Robert Barlow, and Dave Williams were especially helpful. Key members of the ARVO staff included Rachel Necker, Joanna Matthews, Karen Berney, Cindy Fuss, Joon Song, TJ Rainsford, Chi Wei, Dave Roddy, Joanne Olson, Debbie Chin, Jenny Peng, and especially Karen Colson and Alice O’Donnell. Alice O’Donnell served as Managing Editor of JOV from September 2004 until recently, when she assumed the title of Director of Journals. She and I have labored together for seven years, and she has endured my endless demands and complaints. We have exchanged 14,737 email messages.

Among my editorial board, I especially note the wise early counsel of Ted Adelson, Brian Wandell, Tony Movshon, Michael Morgan, David Brainard, and Dennis Levi. Denis Pelli was so regular and so influential a contributor that we created a special position for him on the masthead: Associate Advisor. He has earned that position many times over with his indefatigable support. At JOV-West, Ellen Salud deserves special mention for her contributions to the production of over 147 articles. Finally, I once again acknowledge the least-sung hero of JOV, Cesar Ramirez, who was there from the beginning, sharing ideas and providing essential feedback, and who worked tirelessly and creatively to build the software foundation that powered the first decade of the Journal of Vision.

But the greatest courage shown in the creation of the Journal of Vision was that of the authors. To this radical, novel, uncertain venture they entrusted their most prized possession, their work. It is difficult, with the passage of years, to convey the bravery of the earliest contributors. But without them, and the contributions of all 2,650 authors who followed, the Journal of Vision would never have become a reality.

Appendix A

Journal of Vision Milestones

The following are some key dates in the first decade of the Journal of Vision.

Figure 23. Legend on the back of the first Journal of Vision T-shirt, printed April, 2001.
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