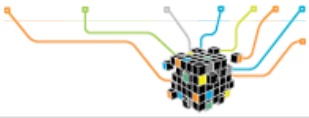

Bits

Business ▪ Innovation ▪ Technology ▪ Society

January 8, 2009, *1:52 pm*

R You Ready for R?

By Ashlee Vance


Statistics professor Robert Gentleman who helped developed the R programming language. (Credit: Stuart Isett for The New York Times)

There seems to be a cathaRsis taking place.

My story published Tuesday on the R programming language has generated a flood of reader e-mail messages. The story covers the software's broad usage and vibrant developer community in detail, but, in short, R helps people deal with large volumes of data in a wide variety of industries, including pharmaceuticals, finance and oil and gas.

Also of note, the software is open source, meaning people can pick it up for free and make their own changes to the code. Such flexibility has inspired statistically minded people of all stripes to get behind R and make it a real success story.

Most of the people reacting to the story expressed pleasure at seeing R receive mainstream attention. People chimed in with the unique ways they're using the technology. Vhayu Technologies talked about its passion for tweaking R to help traders on Wall Street, while others discussed its increasing adoption at universities for everything from biology to economics.

There were also some complaints that my story did not focus enough on S, which was a precursor to R developed at Bell Labs. John Chambers, now a consulting professor of statistics at Stanford University, drove much of the early S work at Bell Labs and talked with me at length about S and R. Without question, R arrived as a result of the fine work done with S, but it's the rapid rise of R, helped by its open-source nature, that has proved so gripping.

Speaking of R, Mr. Chambers said, "It's way beyond anything we could have imagined at Bell Labs."

If you'd like some more of S's history, you'll find it at the end of Mr. Chambers's new book, "Software for Data Analysis."

In addition, the commercial potential of R is worth some further discussion.

Pfizer was a prominent R user mentioned in the story. The company relies on R for its nonclinical drug studies and has shied away from using the technology for clinical research that will ultimately be presented to regulators. For such work, Pfizer instead turns to software from SAS Institute, which brings in more than $2 billion a year in revenue from data analytics software and services.

Were Pfizer to use R in clinical studies, it would run the risk of seeing its research questioned or even rejected by regulators doubting the veracity of results based on what they view as an unknown quantity.

"It's very hard to displace the industry standard in those types of cases," said Max Kuhn, associate director of nonclinical statistics at Pfizer.

Of course, the Linux operating system over the course of many years has managed to rise from an unknown entity to one that has gained top approval from governments around the world for everything from handling

top-secret files to being used for processing tax data. So we'll see what happens with R in the long run.

Revolution Computing stands as one company trying to push the commercial agenda forward with R.

While the base software is free, Revolution offers ways to speed up the software on certain applications and to run it on large computers. In addition, Revolution provides support services to customers like Pfizer and Bank of America. Intel's venture capital arm invested in Revolution last year.

Lastly, some readers had questions on exactly how many people use R. A number of people interviewed, including those who work most closely with the software, estimated the R population at 250,000.

Intel Capital has placed the number of R users at 1 million, and Revolution kicks the estimate all the way up to 2 million.

Such disparity often accompanies open-source projects, where it's difficult to tell just how far a piece of software's tentacles spread and how active the users really, um, R.

Biotechnology, Company News, Enterprise Computing, Start-Ups, Intel, open source, pfizer, programming language, r, revolution computing

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1. 1. January 8, 2009 2:51 pm Link

   I like the story a lot.

   A similar story could be written about Octave and FreeMat, which are open source implementations of Matlab language.

   — *Eugene*
2. 2. January 8, 2009 4:09 pm Link

   I was amused by the comment by the SAS representative that is apparently glad that airplane engine

designers are pushing buttons in a SAS gui ! I'd expect that from a SAS representative but it's another attempt to perpetuate the myth that closed source software controlled by a single company, whose code no one outside of the company can see, is more reliable than open source code that is vetted by a large number of knowledgeable people. Open source software isn't a panacea and proprietary software certainly has a place but it would be nice if there were more transparent discussions of the strengths and limitations of the various software models. But I guess that's unlikely given that some have such a vested interest in the proprietary model.

— *Karl Young*

3. 3. January 8, 2009 4:52 pm Link

Loved the story. Would've been even more interesting if you could have pointed me to some examples of the applications people have created. I guess it seems strange to write a story about open-source software and not open it up to some examples via links.

— *Chris*

4. 4. January 8, 2009 5:43 pm Link

The time to use R in clinical studies is not far away — the FDA is already using it. (Which is why SAS was spreading FUD [fear, uncertainty and doubt] in the original article!)

— *anon*

5. 5. January 8, 2009 6:26 pm Link

Excellent. It is a breath of fresh air to see this system getting the attention it deserves. The audience for R is, however, somewhat narrower than your article suggests.

The comparison to Excel is where it goes off-base::

"Some people familiar with R describe it as a supercharged version of Microsoft's Excel spreadsheet software that can help illuminate data trends more clearly than is possible by entering information into rows and columns."

The statement hints that some significant part of the user base for Excel could use R without much orientation. This is definitely not the case. R would be utterly mystifying to most Excel users. So would SAS.

R is far more procedural (a series of actions or transformations are executed in sequence) than Excel, which is more event-driven (change what's in cell A1, and eveything else recalculates).

R looks and works nothing like a spreadsheet. It is very much script- and function-driven, and it is quite common for there to be few, if any, artifacts in an R workspace that are visually or functionally spreadsheet-like. You can use a tool called R Commander to make it more menu-driven, but it would still be a stretch to call it at all Excel-like.

Most importantly, R (and SAS) requires users to understand the statistical methods they are using - what they are, and when they can and can't be applied. So, if you don't know what a residual or a median is, then either tool would require a serious investment in learning before being any use to you at all.

I like the fact that you can do that learning in R without spending thousands and thousands of dollars on a software license.

— *Bill Seely*

6. 6. January 8, 2009 6:50 pm Link

@Eugene - also Scilab (http://www.scilab.org/) as a Matlab alternative.

— *Marc*

7. 7. January 8, 2009 8:21 pm Link

I find the main argument from SAS against R quite unfortunate, "We have customers who build engines for aircraft. I am happy they are not using freeware when I get on a jet." I don't blame the spokesperson, but I do think it is a very unfortunate argument. SAS has a heavy reliance and indeed support of many "freeware" products by SAS R&D- Java, TomCat, Apache, J2EE, Firebird (embedded in 9.2), etc. Indeed, many of the most expensive and complex SAS products heavily rely on "freeware".

With one exception, you will likely never hear SAS founder and CEO Dr Goodnight say anything good about any other non “freeware” software company (Teradata is the exception but a hybrid since they also sell you the hardware embedded with the software.) In fact, SAS has publicly railed against for profit software companies as buggy, poorly supported, etc. Notable in this category are Microsoft and Oracle. SAS has chosen to actively partners with open source providers for key internal software, “SAS is an innovative user of open source software components” said Douglas A. Levin, CEO of Black Duck. This was when SAS selected Black Duck to ”provide open source management for SAS product development.”

Perhaps the better tact is to discuss how academics use small data, have less need for extensive data management/connections to many RDBM’s, academics have MUCH more time to deliver their analyses, and most importantly- the time required to develop and maintain a new product (R) in an established environment where each new analysis is linked and supported by many other analyses already extant.

Indeed, I think easy and broad R access should be added to SAS ASAP. This is because the real threat to SAS is NOT R. The bigger threats to SAS are JMP (a SAS product at a very attractive price), WPS, SPSS, etc. In fact, WPS may be the biggest threat due to the extensive use of BASE SAS at the core of the most complex work at many SAS customers, which can be migrated to WPS with moderate effort at worst and minimal effort at best. Who is the worldwide partner of this product?

Other SAS pluses include tech support that actually answers the phone and is quite knowledgable, somewhat better documentation, Enterprise Guide for the non-programmer (R Commander and similar GUI’s have been very disappointing in my review of them) and IMO SAS is a simpler language to teach and master. Cons of SAS include price, difficulty of SAS non-technical support, new users who aren’t in college can’t easily license this product beyond Learning Edition, complex product packaging (R suffers from this as well.)

My biggest problems with R is the poor documentation, complex installation (okay, SAS sometimes has this problem), horrible name (try using search engines with such a terse name! it’s gotten better lately but is still a problem), inability to work with large data, and the sometimes inefficient approaches to calculating solutions in various modules (optimizing algorithms is very hard and time consuming.)

Embrace the free alternative SAS! You already do this for many other free products! Think of the users and their ability to stay in one environment (SAS) and call R as needed/convenient! WPS is already bridging to R, which is very smart IMO. If SAS bridges to R, users will likely use SAS for standard analyses and R for unavailable methods in production SAS since SAS almost always performs faster and is better documented.

Many other software companies have squarely competed with open source products and continued to thrive, SAS should be able to do the same in the rapidly growing world of business intelligence, analytics, and data mining. I personally love using SAS but have expanded my toolset significantly in the past few years with great products like JMP and Tableau.

Regards,
Stephen McDaniel
Author, “SAS for Dummies”

— *Stephen McDaniel*

8. 8. January 8, 2009 8:42 pm Link

Excellent story and with predictive analytics going mainstream, R will only gain more momentum and broader acceptance across industries.

Developing models in R, the Predictive Model Markup Language (PMML, http://www.dmg.org) standard allows the exchange of models with various other statistical software solutions.

To enable R users to deploy, integrate, and execute their models in a highly scalable and production-ready infrastructure via PMML, we at Zementis http://www.zementis.com developed the ADAPA predictive analytics decision engine. ADAPA is not open source, but it also breaks with the traditional software license model to deliver more cost-effective predictive analytics solutions. ADAPA is a Software as a Service (SaaS) offer on the Amazon EC2 cloud computing infrastructure.

The combination of open source, open standards, and cloud computing will change the way companies leverage predictive analytics.

Learn more about ADAPA at http://www.zementis.com/

— *Michael Zeller*

9. 9. January 9, 2009 12:25 am Link

As a user of R,SPSS ,SAS and WPS. I find SAS's actions quite puzzling- The big threat to them is from WPS that does the exact functionality of the Base SAS Module at 1/10 th of the Price . WPS has an interface to R , by a guy Phil Rack.

SAS funds a lot of conferences and wikis ,but the fine print uses the term permanent license to use the copyright of those material. SAS as a language threatens to be pried out of SAS Institute's reach, and they make comments like aircraft engines etc.

SAS also funds user groups but only on the condition that a company representative be allowed there. It uses invitations to conferences to some of the key corporate decision makers who renew those licenses.

SAS Institute also outsources a lot of work to its office in Pune , and this does take some shine from its best employer rating as the Indian office doesn't get the same working conditions as the American office.

R is the opposite,no one owns it,people work for the passion of it, if a bug comes on a package, people come together ,and it is fixed in a fast time.
SAS products have and bugs too.

If you want to try out R ,without learning the language download the GUI from http://www.togaware.com which is called Rattle and you would be off in less than 10 minutes . Zementis contributed to the PMML package, and Rattle can build and export PMML code for models.

R is more difficult to learn , but there is now a code reference book called http://www.rforsasandspssusers.com in which you can generate R code by just keeping the book open and looking at the corresponding SAS code.

The reason R and SAS are different is SAS treats people as money generating clients, while R is more of a community product. You can note the difference in reactions your article created by the public archives of both R and SAS list.

I wrote a summary on http://www.decisionstats.com as I found each party trying to just present their pluses without going in to the minuses.

The truth is both R and SAS developers can learn from each other's successes and challenges.

— *Ajay*

10. 10. January 9, 2009 12:32 am Link

The comparison with Excel is not off base - there is a package called RExcel - Quoting Erich from R archives "
There is RExcel (available by downloading the CRAN package RExcelInstaller. It allows to transfer data between R and Excel, and run R code from within Excel. So you can start with your data in Excel, let R do an analysis, and transfer the results back to Excel. You can write VBA macros which do this, but "hidden from exposure",
so the Excel user does not even notice that R is doing the hatd work.

It also has an Excel worksheet function RApply which allows to call an R function from an Excel cell formula. =RApply("rfun",A1)
would apply the R function rfun to the value in cell A1.
If the value in A1 changes, Excel will force R to recalculate the formula.

There is a (half hour long) video demo about RExcel
at http://rcom.univie.ac.at/RExcelDemo/

http://rcom.univie.ac.at/ has more information about the project
"

Hope this helps to put at rest the R and Excel issue.

Ajay

http://www.decisionstats.com

— *Ajay*

11. 11. January 9, 2009 8:18 am Link

SAS, SPSS and R are all wonderfully powerful packages. While SAS and SPSS solve problems in a very similar way, R is radically different. SAS & SPSS users often view R as being difficult to learn because of its different perspective. Once mastered though, R offers a much greater range of flexibility for people who like to program. Two easy-to-use interfaces for R, R Commander and Rattle, have not yet caught up to SPSS for people who like to use menus rather than program. To see in detail how these packages compare, read the free document, "R for SAS and SPSS Users" at http://RforSASandSPSSusers.com, or the book by the same name.

Bob Muenchen
Author of R for SAS and SPSS Users

— *Bob Muenchen*

12. 12. January 9, 2009 8:55 am Link

Nobody mentions the main practical reason for using SAS: it can handle extremely large data sets, no other program can. I agree with the other comments: SAS is horrible. It's a pain to learn and a pain to use.

But with large datasets, there is really no other choice to manipulate the data. My best solution has been to manipulate the data using SAS and SQL through SAS and then analyze them (if they are small enough) with either Stata, which is awesome, or R.

— *None*

13. 13. January 9, 2009 9:16 am Link

Has anyone noted the similarity between R and APL primitive operators for handling rectangular arrays of various data types? This may just be a consequence of inherent needs, but their presence is valuable - as is the ability to handle lists. Very interesting language, even apart from its emphasis on statistical functions.

— *whoever*

14. 14. January 9, 2009 11:42 am Link

I like this discussion and the fact of having another 'Open' tool lauded for statistical research. What seems to be lost in subsequent discussions is the fact that Pfizer (and many others) would rather hide their research and studies as in:

"Were Pfizer to use R in clinical studies, it would run the risk of seeing its research questioned or even rejected by regulators doubting the veracity of results based on what they view as an unknown quantity"

As Ian Ayers points out in his book "Super Crunchers," the more data sets are made available, the better other researchers can validate the methodology, find errors and call a bad study, a bad study.

Is it me or are health, FDA monitoring and medical research large enough issues to warrant scrutiny?

— *Thundermist*

15. 15. January 9, 2009 12:26 pm Link

Now in my second year with R, I would not wish to miss the command line. Sure, coming from a GUI environment the learning curve was steep. In fact, I had to learn plenty more stats along the way, thus reviewing every step.
The real benefit comes in form of packages. Without a handful of packages a significant part of my research would not have been possible!

PS: I love the "sudoku" package!

— *Bernd*

16. 16. January 9, 2009 12:41 pm Link

The connection between R and Excel is the most interesting part of the article (though it was overly brief). The argument that the typical spreadsheet user will be totally befuddled is, I think, specious. First

off, the typical spreadsheet user is already befuddled by their spreadsheet. I also suspect that the fact that R and spreadsheets are completely different might be an advantage rather than a hinderance for people to switch — there are fewer false assumptions to be killed.

In "Spreadsheet Addiction" (http://www.burns-stat.com/pages/Tutor/spreadsheet_addiction.html) I state reasons why spreadsheets are inherently dangerous. I don't know if there will be much of a switch from spreadsheets to R, but there SHOULD be. For many users of spreadsheets both their productivity and accuracy would improve dramatically by switching to R.

— *Patrick Burns*

17. 17. January 9, 2009 1:46 pm Link

I'm Anne Milley, the SAS person quoted in Ashlee Vance's story this week on R. I've read and heard much passionate feedback on my comments, and wanted to give a more complete response. Take a look at my blog post on sas com Voices for more: http://tinyurl.com/9qrnk7 Bottom line: SAS and I respect R, and my airplane comment notwithstanding, embrace open-source too. At the same time, as marketing director for a major (and growing) commercial software company, I feel strongly that there are some key differences in the needs R and SAS address. Would love to hear your feedback on my post and on SAS.

Anne Milley
Anne.Milley@sas.com

— *Anne Milley*

18. 18. January 9, 2009 4:55 pm Link

I'm an advanced Excel user with a great deal of charting experience. To enhance my Excel charts, I learned Visual Basic for Applications (VBA) to overcome some of Excel's charting limitations.

I am now in the process of moving to R because of its excellent graphical analysis capabilities that Excel users can only dream about. I'm documenting my transition from Excel to R in a blog: link .

I encourage Excel users to who find themselves facing limitations with Excel to take a hard look at R. The advantages of R are well worth the learning curve climb.

D Kelly O'Day
koday@processtrends.com

— *D Kelly O'Day*

19. 19. January 9, 2009 9:04 pm Link

Like others, I was initially exposed to R while doing graduate work in computational biology. One thing you don't mention is R's steep learning curve: R makes hard things easy (kernel density estimation in one line of code), but easy things can be hard (like working with lists).

As Joe Hellerstein has put it, we are in the midst of an "Industrial Revolution of Data": cell phones, RFID tags, and web servers are all throwing off rivers of data. R's one tool to help the next generation of analysts make sense of Big Data.

Incidentally, for the New Yorkers, I'm giving a talk in a few weeks on the topic of using R for 'open source analytics': http://en.oreilly.com/money2009/public/schedule/detail/5146

Mike
mike @ dataspora.com

— *Michael E. Driscoll, Ph.D.*

20. 20. January 10, 2009 9:26 am Link

One of the common complaints about the article on the always-busy R-help mailing list was that it failed to give enough credit to the developers of the S language, on which much of the syntax, basic data structures, and object-oriented programming model of R are based. (This is corrected to some extent in the on-line follow-up posting.) So, a tip of the hat to John Chambers and his AT&T collaborators Rick Becker and Allan Wilks. This in no way detracts from the immense contribution of Rob Gentleman and Ross Ihaka in rewriting the core language and initiating a massive open-source project that has mobilized the creative efforts of contributors too many to name here.

An interesting sidelight here is that when John was awarded a major prize by the Association for

Computing Machinery (ACM) (http://awards.acm.org/citation.cfm?id=6640862&srt=all&aw=149&ao=SOFTWSYS), he donated it to the Statistical Computing Section of the American Statistical Association to endow an annual student award for innovations in statistical software. Pay it forward!

— *Alan Zaslavsky*

21. 21. January 10, 2009 11:41 am Link

I would certainly agree with many of the comments about the advantages of R as an open source statistical language, especially in support of basic academic research. I would also congratulate the R community on what they have created.

However, there are a couple of reasons that I believe that SAS will continue to be a very dominant force in the long run in higher-end business and government analytical applications like machine learning and data mining. First, as was mentioned above, the ability of SAS to handle large datasets is unmatched. R runs into speed problems when the For Loop is used. There are ways around this with vectorization and this will be easier to achieve with 64 bit standards, but there are many problems in advanced analytics where vectorization is not a solution. A second reason is that SAS is now closed and secure enough for intellectual property for big business and government applications. While there might be hundreds of analytical methods available in R, they all suffer from the same well known problems inherent in public domain advanced analytical methods. If somebody comes along and develops an analytical method without these problems and wishes to sell it for higher end business and government practice, where will they go? The answer is directly to SAS. If this is correct, the field of advanced analytics will become much more like the pharmaceutical or neutroceutical industries where valuable new breakthroughs are patented or kept as a trade secret. R and its large group of university users will still be valuable for basic statistical work, but the bridge to the business world application will likely still go through SAS for many who wish to profit from a discovery.

SAS is a very successful private company still run by the original management. SAS is an American success story that serves as a role model for anyone with truly entrpreneurial analytical ambitions. It is far too early in this game to write SAS off, as they have been the major player to date and the most interesting developments in advanced analytics and machine learning have only begun. I believe that SAS will continue to be the major player in this game. When this becomes clear, those who believe that SAS is no longer needed for higher-end business or government application will be left in the dust.

— *SAS Defender*

22. 22. January 10, 2009 5:01 pm Link

I am a PhD economist. The nature of my work makes my software requirements rather stringent. I am also in private practice, so I must pay attention to the cost of my kit. I have tried R and liked it, but I will stay with Stata. I just happen to have a longer history with it — eight years — and I have benefited greatly from prompt and competent help, all free on the wonderful Statalist.

Stata is also an American success story. It is a privately held company with a great product. William Gould, the president of StataCorp and creator of the original kernel, is still developer-in-chief. He answers user questions on the Statalist routinely, as do all of the senior staff at StataCorp.

Free and open-source is great. I use OpenOffice and Cygwin every day and I am grateful for them. But also great are Stata's programming language, documentation, outstanding technical support, and the peer-reviewed Stata Journal. All of those things cost money to produce and should not be expected to be available free.

I am happy for R's growing popularity. I learned my way around it one Christmas break while being snowed in with my laptop and a copy of John Fox's "An R and S-Plus Companion to Applied Regression" and I had a great time. But the Stata features I mentioned above are such a great help for my productivity and come at such an honest price that I don't think I'll ever switch.

— *Gabi Huiber*

23. 23. January 11, 2009 7:55 am Link

With regard to to the use of R in clinical studies, mentioned above, the issue of validation applies to any software used for the statistical analysis of the data, not R or open-source software as a whole. AFAIK, the FDA do not dictate what software is used to analyse that data.

Several R community members recently got together and started a process of writing a certification

document for R that addresses the use of R in clinical trails. This document has been adopted by the R Foundation for Statistical Computing and is available from the R website:

http://www.r-project.org/certification.html

Max Kuhn's comment attests to the inertia that needs to be overcome to get R used in clinical trials, not to any inherent problems with using R itself.

— *Gavin*

24. 24. January 11, 2009 10:14 am Link

As a long time user of S, Splus and now R, I loved the article on R until I read the paragraph on how it all started.

I quote:
"According to them, the notion of devising something like R sprang up during a hallway conversation. They both wanted technology better suited for their statistics students, who needed to analyze data and produce graphical models of the information. Most comparable software had been designed by computer scientists and proved hard to use."

This is grossly ungenerous to the original inventors of the wonderful S language underlying the R system.

The fact is, what Gentleman and Ihaka did do was provide a free implementation of the S language for data analysis and graphics. Although this was a noble undertaking, it is the evolution of this same S language that is loved and used by all R users today.

The S language was invented by John Chambers at Bell Labs in the early 80s, and developed further by him and his colleagues over the next 20 years. The 1988 book "The New S Language: A Programming Environment for Data Analysis and Graphics" (Richard A. Becker, John M. Chambers, Allan R. Wilks, Wadsworth) set the stage (note that this subtitle is paraphrased in the motivation paragraph above). The S language was licenced by Bell Labs to a software company StatSci around 1990 (later called Insightful) which marketed, popularized and further developed their implementation called Splus.

With the help of an ever-strengthening team of "R-core" developers and other volunteers, R eventually became reliable enough for hardcore Splus users to switch (for many around the year 2002). R has grown in leaps and bounds in recent years, to become the powerful, wonderful, and free software tool enjoyed by almost all statistics research groups in the world, as well as many industries.

— *Trevor Hastie*

25. 25. January 11, 2009 11:25 am Link

There is a new "magic" language every year or two. It's not the language, but the people who use it, that make the difference. Think APL, COBOL, FORTRAN, Assembler, PARS, C, C++, c#, Java, Ruby, Rexx, Basic, LOGO, etc, etc, etc. All great, all can do magic, all have cult followers.

It's what you do with the language that matters.. Fashion is wonderful, but…

— *JohnB*

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— SHP
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> " It's looking pretty scary these days in Italy in terms of rights. If Google doesn't win, it will be a big blow to the free, open Internet, but to people living in Italy especially."

— Sarah
Google Executives Face Jail Time for Italian Video

> " In this case, Google Video is more like a newspaper which would publish anything without review (hate speech letters, personal information, slander, whatever) for the broad public."

— Ellemer
Google Executives Face Jail Time for Italian Video

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— laurel nyc
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Contributors

Damon Darlin

Technology editor, San Francisco

Consumer electronics, consumer issues, pricing

- Posts | Profile | E-mail

David F. Gallagher

Deputy technology editor, New York

Internet, blogs, search, cellphones

- Posts | Profile

Vindu Goel

Deputy Technology Editor, New York

Social networking, telecommunications, enterprise technology, blogs

- Posts | E-mail

Sam Grobart

Assistant Technology Editor, New York

Cellphones, cameras, computers, home & entertainment technology

- Posts | E-mail

Saul Hansell

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