

# TNIT

# newsletter

Toulouse Network for Information Technology

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# Welcome



*Just in time for summer, some reading for the beach. We begin by an interview of Ilya Segal, and end by a discussion of the role of IT in the health industry by Jon Levin. And for those of you who need more to bring to the beach, Bruno Jullien provides you with a guided tour of the literature on two sided market. But remember to be French enough to take some real time out!*



Jacques Crémer

**DON'T FORGET**

Sixth bi-annual conference on  
**The Economics of Intellectual Property, Software and the Internet**  
*Toulouse, January 13-14, 2011*

The Toulouse Network for Information Technology (TNIT) is a research network funded by Microsoft and managed by the Institut d'Economie Industrielle. It aims at stimulating world-class research in the Economics of Information Technology, Intellectual Property, Software Security, Liability, and Related Topics.

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Ilya Segal is Professor of Economics at Stanford University and one of the leading economic theorists of his generation.

# Interview with Ilya Segal

**TNIT:** *Ilya, is your recent work on search your first applied paper?*

**IS:** It is my first empirical paper, but I have a number of applied papers using theoretical approach. Actually, it is a common misconception these days in economics that applied research must necessarily be empirical and use statistical analysis. The distinction between applied and fundamental research is not the same as between theoretical and empirical research. Applied research concerns itself with questions of immediate practical importance – e.g. business practices or policy issues – using both theoretical and empirical techniques. A large number of so-called “applied theory” papers do not do any empirical research, instead building on “stylized facts” emerging from previous empirical work, and deriving testable implications for new empirical research. At the same time, fundamental research need not be purely theoretical – e.g., there exists a large body of empirical/experimental research whose main goal is deeper understanding of fundamental human behavior rather than any specific applied question.

My own “applied” research applied contract theory to understanding contracts between firms. Such contracts often attract antitrust scrutiny – for example, when they involve exclusive or tying clauses. The “Chicago school” argument claims that any voluntary contract among parties should be allowed since it can only raise aggregate welfare. However, the argument fails when the contract has adverse effects (“negative externalities”) on third parties. The obvious example is negative externalities from “horizontal” pre-fixing agreements between competitors. But “vertical” contracts along the supply chain can also generate externalities – for example, contracts that contain exclusive or “tying” clauses may have an adverse effect on entry, and thus warrant antitrust scrutiny. However,

such contract may also have efficiency justifications – for example, their effect on the parties’ incentives to invest in the relationship. These issues came up in the US Antitrust investigation of Microsoft’s contracts with OEMs (original equipment manufacturers) in the 1990s. Together with Michael Whinston (another TNIT member), I conducted a few theoretical studies of potential precompetitive and anticompetitive effects of exclusive contracts. Of course, it would be good to supplement these studies with empirical work. The problem is that the data is hard to come by, since firms tend to closely guard their contracting terms – that is, until an antitrust investigation forces their disclosure.

**TNIT:** *The internet can provide us with large amounts of data on consumer behavior that would have before been inaccessible. What do you think are the interesting questions that can be answered with it? What are the limitations of doing empirical research? And how did you personally like it?*

**IS:** It is true that the potential for new empirical research is enormous. But from my experience, the data makes it more rather than less important to be guided by theory and ask interesting questions. That is, data and theory are complements rather than substitutes. Internet companies now constantly tinker around the edges with their products (e.g., adjusting settings of internet auctions, privacy settings in Facebook, etc.), conducting large-scale randomized micro-experiments (e.g., show different things to different people) and collecting enormous datasets. While such experimentation could be extremely useful, when done without an underlying model of human behavior, the results could be misinterpreted and yield misguided decisions. The value-added of economists is in building theoretical models to predict long-run behavioral responses to systematic changes, which cannot be done by a simple statistical analysis of micro-experiments. Also, our theories should offer guidance as to which changes



should be considered and which micro-experiments are worth running.

On the practical level, a key problem I encountered is that internet companies are in no hurry to make their data available to researchers. My own empirical work used Microsoft's data on user clicking behavior that was distributed on a DVD to selected researchers. But this data was extremely limited – e.g., it had no user histories, and no data on advertising auctions. I understand that there are significant privacy issues that must be overcome before extensive data can be made public. I hope that these issues can be overcome soon. For now, the number of economists who have long-term access to in-house internet data can be counted on the fingers of one hand.

*TNIT: You have done, and continue to do, quite a bit of work on antitrust issues. One of the remarkable aspects of IT is how fast a firm can acquire an impressive market share worldwide (think of Facebook). How do you think antitrust authorities should react?*

**IS:** Definitely, internet service companies exhibit fundamental economies of scale - not only due to negligible marginal costs, but also because the scale allows product improvements using more data and more experimentation. In the case of Facebook, social network externalities are also critical. Thus, we shouldn't be surprised by Facebook's high market share – in fact, this is also an efficient ("first-best") outcome, and may also be indicative of Facebook's high value to its users.

Antitrust analysis should only worry about high market shares when it amounts to a barrier to future entry. Traditional antitrust analysis has focused on the leader's resulting ability to charge high prices. Michael Whinston and I examined what we believe to be a potentially more serious consequence of monopoly in high-tech markets - potential slowdown of innovation. We examined the effects of antitrust regulation on long-run innovation.

However, I believe it is too early to regulate Facebook. The company has not yet found a profitable business model, and is still constantly innovating. In some not-too distant future, perhaps, if the company becomes profitable and innovation dries up, some regulation would be warranted. Namely, I am thinking of mandating social networking platforms to be interoperable and to allow users to move their data across the platforms. This would be similar to the current regulation of telephone networks, which requires that users can call each other no matter which network they are on, and that they can take their phone numbers with them when switching mobile networks.

*TNIT: Finally, you have done a certain amount of work in collaboration with computer scientists. Any thoughts about the differences in the way in which economists and computer scientists think about the same problems? What can they learn from each other?*

**IS:** Economists tend to focus on incentives, assuming full rationality (optimization) by economic agents, while computer scientists focus on bounded rationality (such as computational and communication constraints), which makes full-blown optimization infeasible. However, there is a long tradition in economics (going back at least to Nobel laureates Hayek, Simon, and Hurwicz) of taking bounded rationality seriously and examining its implications for economic organizations. This tradition was all but forgotten by the last generation of economists, but the importance of bounded rationality became clear in designing complicated computerized marketplaces, and so economists working in this area had to take it into account. In turn, economists taught computer scientists about the importance of incentives. Thus, methodological barriers between economists and computer scientists have been disappearing over the last decade.

Economists often understand rationality as optimizing expected payoff using some Bayesian prior. (Theorists call this "Savage's expected utility model.") However, in many practical situations there is not enough data to construct a prior with any reasonable confidence. The main approach of computer scientists is to instead construct a mechanism that performs "robustly" across a variety of settings, even if it need not be optimal for any given prior. This approach is similar to what is used in engineering: instead of designing a "fully optimal" bridge, the engineer designs a bridge that would be "robust" within some load range. This engineering approach has been recently adopted by some economists working on designing "robust" economic mechanisms.

The importance of uncertainty that cannot be quantified with a prior is one of the lessons of the latest financial crisis. Indeed, many observers attribute the crisis to traders' and regulators' blind reliance on probabilistic models without checking their robustness to alternative scenarios. It seems to me that the crisis could have been softened or averted if traders and regulators instead used models of decision-making under "ambiguity," which had been developed by economic theorists, and are now finding more applications in macroeconomic and finance.

*TNIT: A few short questions. You have many papers on issues linked to limited communications. What differentiates 'classical' methods of face to face communication from the new technologies? Is the fact that communication is becoming cheaper and faster and more abundant not solving all these problems?*

**IS:** While communication bandwidth and computational capacity have become cheaper and more abundant, the real "bottleneck" now is the human brain. To give an example, suppose you are bidding in a combinatorial auction with 50 objects, in which you can bid on each



bundle of objects. To bid your true willingness to pay for each bundle of objects, you would have to submit  $2^{50}$  numbers, which is about  $10^{15}$  numbers - more data than in the entire U.S. Library of Congress! While this amount of information can now be stored and processed on computers, we cannot expect a human to remember, communicate, and process this information in a fully rational way. Some believe that human brains process information fundamentally differently from computers, and still cannot be matched by computers in many tasks (although I just read about an IBM computer beating humans in Jeopardy!). Still, most people recognize that both humans and computers face fundamental computational and communication constraints, even though they respond to these constraints differently.

**TNIT:** *If you were not an economist, what would you choose to be? A physicist, a mathematician or a computer scientist?*

**IS:** My father was a physicist and he taught me the art of combining formal mathematical reasoning with intuition to tackle practical problems. So, I think I would have been an applied mathematician, but perhaps applying math to physics rather than economics. In fact, my undergraduate degree in the USSR was in "Applied Mathematics and Control," with the word "control" also standing for "management" in Russian. While the leading application of control theory was designing control systems for intercontinental ballistic missiles, the same theory was also deemed useful for "controlling" the economy - e.g., pointing it at the maximum-growth trajectory. Of course, incentives and innovation did not feature in that theory. Curiously, the Russian authorities are now trying to recreate the Silicon Valley in a Moscow suburb - all centrally planned, of course.

**TNIT:** *MBA students at Stanford are well known for being specially attracted by the proximity of the Silicon Valley and the opportunity it provides. You are Director of the PhD program in economics at Stanford. Do you feel that the doctoral student in economics also take advantage of the proximity of so many high tech firms?*

**IS:** There are many advantages, but also a disadvantage. The advantages include the flow of interesting research questions and data emerging from these companies (however, see the above caveat on the data). Some of our students have internships at these companies, while others work with faculty members on projects with these companies. The disadvantage is that some (not many) students get "pulled" into working for these companies instead of doing academic research. I understand the attraction of having an immediate practical impact on the world (and also making some money in the process). But I think the primary motivation for academic research should instead be curiosity and love of knowledge.

**TNIT:** *And some fun questions. Do you miss the Russian (and Bostonian!) cold and the snow in Winter?*

**IS:** It's easy to get used to good things. I must say that when I moved to California I was worried - how could I get any work done in this climate, and isn't this a place people go to retire? But then Matt Rabin (a Berkeley colleague) set me straight: in a bad climate, whenever the weather is agreeable, you have to drop everything and run outside. But in California, you don't have to run outside, since you know that the weather will be just as nice tomorrow as it is today. So you can still get work done in California, and take time off on your own schedule. In addition, as I now realize, your incentive to work is much higher in California - just because your mortgage is a lot bigger! Perhaps these factors help explain Stanford's representation in TNIT?

**TNIT:** *Which joke makes you laugh more:*

*"Why do programmers always mix up Halloween and Christmas? Because Oct 31 equals Dec 25."*

*Or "In a dark, narrow alley, a function and a differential operator meet: 'Get out of my way - or I'll differentiate you till you're zero!' 'Try it - I'm e^x ...'"*

**IS:** I used to laugh at jokes like these - when I was in college! At least I am still young enough to "get" them.

**TNIT:** *Touch Type or Secretary?*

**IS:** Type

**TNIT:** *Any social network?*

**IS:** I registered on all of them out of curiosity but don't use any (apologies to everyone who tried to "friend" me!). I admire people who are able to live their social and intellectual lives in public, but I don't have the time and energy for this. I think that anyone who is interested in my life and my opinions knows how to ask me directly.

**TNIT:** *JSTOR or paper copies in library?*

**IS:** JSTOR, even if the journal is on the shelf next to me.

**TNIT:** *Coffee or mineral water?*

**IS:** Coffee in the morning, water in the afternoon

**TNIT:** *Thank you very much for this interview!*



# A reading list on two sided markets

by **Bruno Jullien**

Bruno Jullien is “Directeur de Recherche au CNRS” and a researcher at the Toulouse School of Economics. He has been one of the pioneers in the study of two sided markets.

**T**wo sided markets are markets where “platforms” offer the service of putting in contact two different categories of customers. The classical, and overused, example is nightclubs which need both female and male consumers, but there are many others: market places (buyers and sellers); credit cards (consumers and merchants); operating systems (users and sellers of software). While some specific two-sided activities have been studied for a long time, it is only during the 2000’s that the concept of two-sided market has been formalized; following the awareness that it captures a unifying framework for the study of many platform activities.

## Reference articles

- Caillaud, B. and B. Jullien (2003), *Chicken and Egg: Competition Among Intermediation Service Providers*, Rand Journal of Economics, 34(2), 309-328.
- Armstrong, M. (2006), *Competition in Two-Sided Markets*, Rand Journal of Economics, 37 (3), 669-691.
- Rochet, J.-C. and J. Tirole (2003), *Platform Competition in Two-Sided Markets*, Journal of the European Economic Association, 1(4), 990-1029.

The first article analyzes price competition between undifferentiated platforms. The second article is concerned with differentiated platforms. Rochet and Tirole attempt to develop a general treatment of platform competition.

## Surveys

- Rochet, J.-C. and J. Tirole (2006), *Two-Sided Markets: A Progress Report*, RAND Journal of Economics, 37(3), 645-667.
- Rysman, M. (2009), *The Economics of Two-Sided Markets*, Journal of Economics Perspective, 23(3), 125-144.

The article by Rysman is a good introduction to the topic, with some applications. Rochet and Tirole presents the state of the art in 2006 in an illuminative way.

## Heterogeneity and discrimination

A key issue in the analysis of platforms is the effect that different types of heterogeneity between consumers on the “same side” of the market have on participation rates, usage and pricing.

- Weyl, G. (forthcoming), *A Price Theory of Multi-Sided Platforms*, American Economic Review.
- Damiano, E. and H. Li (2008), *Competing Matchmakers*, Journal of the European Economic Association, 6, 819-844.
- Ambrus A. and R. Argenziano (forthcoming), *Asymmetric Networks in Two-Sided Markets*, American Economic Journal -- Microeconomics.

Weyl’s article is the most up to date treatment of the pricing issues, accounting in particular for heterogeneity and coordination issues. The second paper introduces the idea that prices affects not only the volume of participation but also the quality of the pool. The last one shows how endogenous platforms differentiation may emerge through self-selection of participants.

## Vertical contracting

- Hagiu, A. (2006), *Pricing and Commitment by Two-Sided Platforms*, Rand Journal of Economics, 37 (3), 720-737.
- Armstrong, M. and J. Wright (2007), *Two-sided Markets, Competitive Bottlenecks and Exclusive Contracts*, Journal of Economic Theory, 32(2), 353-380.
- Peitz, M., Nocke, V. and C. Stahl (2007), *Platform Ownership*, *The Journal of The European Economic Association*, 5(6), 1130-1160.

Hagiu studies the consequences of strategic commitments by platforms vis-à-vis each side in dynamic contexts. Armstrong and Wright analyse the strategic use of exclusive contracts, while Peitz, Nocke and Stahl are concerned with vertical integration between the platforms and the agents on one side of the market.

## Designing the platform

These articles are first attempts to discuss the design and quality of service of the platforms from a two-sided market perspective.

- Hagiu, A. and B. Jullien (2008), *Why Do Intermediaries Divert Search?*, Harvard Business School, <http://bit.ly/cXOhx5>



## A reading list on two sided markets

- Parker, G. and M. W. Van Alstyne (2005), *Two-Sided Network Effects: A Theory of Information Product Design*, *Management Science*, 51(10), 1494-1504.

### Tying in two-sided markets

*The analysis of tying two-sided markets may differ from standard analysis (discrimination, foreclosure,...) in that tying may help coordinating the two sides of the market.*

- Rochet, J.-C., and J. Tirole (2008), *Tying in two-sided markets and the honor all cards rule*, *International Journal of Industrial Organization*, 26(6), 1333-1347.
- Choi, J.P. (forthcoming), *Tying in Two-Sided Markets with Multi-Homing*, *Journal of Industrial Economics*, <http://bit.ly/bgMGlw>
- Amelio, A. and B. Jullien (2007), *Tying and Freebies in Two-Sided Markets*, IDEI Working Paper, <http://bit.ly/amtv3Q>

The first paper discusses tying credit and debit cards, the second tying a system and applications. The last paper discusses tying as a mean to subsidize participation with implicit negative prices.

### Some empirical papers

*There is a small, but increasing, number of empirical papers on two-sided markets. These are interesting studies.*

- Rysman, M. (2004), *Competition between Networks: A Study of the Market for Yellow Pages*. *Review of Economic Studies*, 71(2): 483–512.
- Cantillon, E. and P.L. Yin (2008), *Competition between Exchange: Lessons from the Battle of the Bund*, ECARE Working Paper, <http://bit.ly/9KhM3B>

- Fillistrucci, L. and E. Argentesi (forthcoming), *Estimating Market Power in a Two-Sided Market: the Case of Newspapers*, *Journal of Applied Econometrics*, <http://bit.ly/9mGm1N>

### Applications

*Finally a number of papers that develop a two-sided market approach concerning different sectors.*

- Anderson, S. and J. Gabzewicz (2006), *The Media and Advertising: A Tale of Two-Sided Markets*. In *Handbook of the Economics of Art and Culture*, Vol I, ed. Victor A. Ginsburgh and David Throsby, chap. 18. Boston: Elsevier.
- McCabe, M. and C. Snyder (2007), *Academic Journals Prices in The Digital Age: A Two-Sided Market Model*, *B.E. Journal Of Economic Analysis and Policy*, 7(1), Article 2.
- Rochet, J.C. and J. Tirole (2002), *Cooperation among Competitors: Some Economics of Payment Card Associations*, *RAND Journal of Economics*, 33(4): 549-570.
- Laffont, J.J., Markus, S., Rey, P. and J. Tirole (2003), *Internet Interconnection and the Off-Net-Cost Pricing Principle*, *The RAND Journal of Economics*, 34(2) 370-390.
- Laffont, J.J., Rey, P. and J. Tirole (1998), *Network Competition: I. Overview and Nondiscriminatory Pricing*, *The RAND Journal of Economics*, 29(1), 1-37.
- Evans, D., Hagiu, A. and R. Schmalensee (2006), *Invisible Engines: How Software Platforms Drive Innovation and Transform Industries*, MIT Press.



# How, **why**, when, who, what?

## **Why** hasn't IT transformed US Health Care? And will it? by Jonathan Levin

Health care, unlike other major sectors of the U.S. economy such as retailing, manufacturing, and financial services, has yet to experience an "IT revolution". Although hospitals and physicians use computerized billing, and insurers compile data on administrative claims and drug prescriptions, information technology plays a relatively small role in health care delivery. According to the 2009 National Ambulatory Medical Care Survey, less than half of physician offices maintain patient records electronically, and fewer than 10% have what the Department of Health and Human Services defines as a fully functioning electronic health record system.

It is easy to think of ways in which electronic health records (EHRs) might lead to benefits in clinical practice. Nowadays, patients frequently receive care from a number of physicians, specialists, and other professionals. An EHR can permit all of these providers to access complete health information on patients rather than having to transmit information back and forth using phone calls and faxes. A well-designed EHR system can provide reminders about preventive care, information about clinical guidelines, drug interactions, and other decision support.

Storing data electronically can also allow a physician or healthcare organization to track patients at a population level, and more easily measure performance and clinical outcomes. In principle, data can be transmitted and aggregated to allow tracking of epidemics, post-approval monitoring of drugs and devices, and a wide range of clinical and health systems research. In fact, many of these benefits seem so obvious it is hard to believe they are not possible today.

So why hasn't IT been adopted and utilized more widely? One answer lies in the organizational and economic structure of the health care system. Health care delivery in the United States is highly fragmented. More than half of U.S. physicians work in groups of fewer than five physicians. A typical Medicare enrollee might see physicians from six or seven organizations in a given year. This structure makes it difficult to internalize the data-sharing and coordination benefits promised by EHRs.

The payment system also plays an important role. Most physicians are compensated on a fee-for-service basis, which creates little incentive to invest in technologies that would reduce duplication or increase efficiency, and also supports the fragmented organizational

structure we currently have. It is hardly surprising that the leading users of IT are large integrated organizations such as Kaiser Permanente, which are paid on a capitated basis.

Recent federal policy initiatives could begin to change this. In 2009, as part of the stimulus bill, Congress allocated roughly twenty billion dollars to promote health IT. Physicians who adopt EHRs and satisfy a "meaningful use" requirement can receive subsidy payments from Medicare. Starting in 2015, non-adopters will have their Medicare reimbursements reduced. Already, there has been a proliferation of cloud-based EHR systems aimed at small physician groups, and a large fraction of physicians are likely to adopt EHRs in the not-too-distant future.

Of course, the mere adoption of electronic records may not have a major effect. In fact, the first draft of the meaningful use criteria spells out tasks so basic that one worries what physicians would be tempted to do with their new EHR systems absent the regulatory requirements. Still, it seems possible that EHR adoption will be complementary to other reforms. Improvements in measurement frequently enable improvements in contracting, and a great deal of economics research supports the claim that IT can facilitate increases in organizational efficiency.

The stimulus bill also contains another, and possibly even more far-reaching idea, which is to link patient records into a national health information network. Such a project faces substantial challenges, including concerns about privacy, difficulties in agreeing to technological standards, and the likely resistance of hospitals and other health organizations to share proprietary data. The federal government has also outlined a plan that envisions health organizations exchanging documents, but does not require data to travel with patients or be readily assembled and aggregated for public health uses.

These more ambitious steps are probably needed to realize the benefits described above, and certainly if we learn anything from the experience of technology industries over the last fifteen years, it is the power of creating a flexible communication platform and unleashing market innovation. If these things happen, who knows? Maybe in ten years some of the engineers developing iPad applications will be trying to improve the healthcare system.





## Sixth bi-annual conference on

# The Economics of Intellectual Property, Software and the Internet

*Toulouse, January 13-14, 2011*

➔ **THE OBJECTIVE OF THE CONFERENCE**, co-sponsored by the Institut D'Economie Industrielle and the Toulouse School of Economics, is to discuss recent academic contributions to the economics of Intellectual Property, and of the Software and Internet Industries, whether theoretical, econometric, experimental or policy oriented. There will be an increased emphasis on intellectual property compared to previous conferences in the series because of the growing importance of IP issues for research and for policy.

➔ **TOPICS TO BE COVERED** include (this list is suggestive and not exhaustive; all contributions to our understanding of these industries and their impact on the economy in general are welcome):

- The industrial organization of the software and internet industries (competition and regulation, contractual relationships, strategies of firms, demand).
- Issues in intellectual property policy.
- Consequences for growth and employment of the software and internet industries.
- E-Commerce, including jurisdictional issues/taxation and competitive strategies.
- Social networking and Web. 2.0.
- New technologies of information and communication and the organization of firms.
- Standards and intellectual property patents.
- Software platforms as two-sided markets.
- The economics of cloud computing.
- The economics of R&D.
- Internet advertising.

➔ **THE SCIENTIFIC COMMITTEE** is composed of Philippe Aghion, Susan Athey, Nick Bloom, Luis Garicano, Neil Gandal, Bengt Holmstrom, Jon Levin, Preston Mc Afee, John Van Reenen, Ran Spiegel and Hal Varian.

➔ **THE ORGANIZING COMMITTEE** is composed of Jacques Crémer and Paul Seabright.

➔ **PROSPECTIVE PARTICIPANTS** are invited to pre-register and/or to submit papers by sending an e-mail to [softint@cict.fr](mailto:softint@cict.fr). Papers should be received by 30 September 2010 (abstracts will be considered, but papers are preferred). A decision will be made by 24 October 2010.

➔ **REGISTRATION FEES**: € 200 (includes lunches, conference dinner and coffee breaks). Waived for speakers and discussants, special rates for certain other attendees.

**FURTHER INFORMATION** is available on the conference web page, and more specific information will be sent to those who have pre-registered. Travel on the base of economy class, accommodation and local expenses will be provided for speakers. For further information contact the conference secretariat:

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