

Vincent F. Hendricks · Pelle G. Hansen

# INFOSTORMS

*Why do we 'like'?  
Explaining individual behavior  
on the social net.*



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Why do we 'like'? Explaining individual  
behavior on the social net

Second Edition



Copernicus Books is a brand of Springer

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ISBN 978-3-319-32764-8  
DOI 10.1007/978-3-319-32765-5

ISBN 978-3-319-32765-5 (eBook)

Library of Congress Control Number: 2016948122

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*For Horacio Arló-Costa,  
an excellent mind and a great friend  
who passed away much too early*



# Preface

*Infostorms* has turned out to be a book with a long shelf life and a chronic mission. The first edition came out in February 2014, and since then the book and its message have proliferated widely in both the analogue and digital worlds. The high point so far was in February 2015, when the Carlsberg Foundation generously decided to fund the start-up of the **Center for Information and Bubble Studies** (CIBS) at the University of Copenhagen, based in no small part on the research agenda and initial results originally put forth in the first edition of *Infostorms*. In the press release following the news of CIBS, the chairman of the Carlsberg Foundation, Professor Flemming Besenbacher, explained, “The activities of CIBS stem from innovative interdisciplinary thinking about basic research in the humanities. The research activities promise practical impact and thus the Center is a pivotal example of Scientific Social Responsibility.” The goal of this second edition, heavily revised and expanded from the first, is to take this interdisciplinary scientific goal and

responsibility even further. We have to understand what and why we “like,” thus thoroughly explaining both individual and group behavior on the social “net”—for better as well as for worse.

Revising and editing the second edition has again been at the same time revitalizing, disheartening, and harmonizing. It has been revitalizing because from time to time, we, as humans, despite the infostorms that are ravaging, are nevertheless able to act rationally and differentiate between what is mere information and what is knowledge; the two are not mutually exclusive, nor are they necessarily convergent. It has been disheartening because we ourselves, and what we think others think, social media, crowd-opinion systems, politicians, the press, and many other bullhorns to the world, often enough seduce us with incorrect information leading to disastrous decisions. It has also been harmonizing, since the logical, philosophical, psychological, mathematical, financial, and game theoretical considerations on which this book’s analyses are based, appear to apply to real-life phenomena and events that affect our everyday lives and of which we ought to be cautious.

For constructive comments, significant proposed amendments to both the first and second editions, as well as encouragement on the way, we would like to thank Alexandru Baltag, Robert A. Becker, Flemming Besenbacher, Christoffer Bjerre Haase, Thomas Bolander, Richard Bradley, Adam Brandenburger, Johan van Benthem, Henrik Boensvang, David Budtz Pedersen, Jerome L. Coben, Nemo D’Qrill, Ulrik Haagerup, Henriette Divert-Hendricks, Robin Engelhardt, Luciano Floridi, Nina Gerasimczuk, Christoffer Bjerre Hasse, Joseph-Maria Hansen, Jeffrey Helzner, Maja Horst, Kevin T. Kelly, Dominik Klein, Hanna Van Lee, Laurs Leth, Hannes Leitgeb, Christian List, Fenrong Liu, Jan Lundorff Rasmussen, Teit Molter, Poul Madsen, Thomas Myrup Kristensen, Larry S. Moss,

Søren Gosvig Olesen, Johan G. Olsen, Erik J. Olsson, Stig Andur Pedersen, Philip Pettit, Rie Smitha Bisgaard Pedersen, Maj Riis Poulsen, Frederik Preisler, Anders Rahbek, Andreas Ramos, Rasmus K. Rendsvig, Lars Rohde, Olivier Roy, Benjamin Rud Elberth, Evan Selinger, Sonja Smets, Nina Smith, Frederik Stjernfelt, John Symons, Peter Norman Sørensen, Dan Zahavi, Kevin Zollman, Mads Vestergaard, Pascal Weinberger, Joachim Wiewiura and Gregory Wheeler.

Last but not least, we would like to thank Milton W. Hendricks for some of the illustrations, our publisher Copernicus Books/Springer Nature in New York City, Patrick Carr, Matthew Giannotti, Ties Nijssen, Rhea Talbert and Christi Lue from Springer Nature, and our publicist, Leah Paulos, for doing so much for this book with an enduring mission.

Copenhagen, Denmark  
Roskilde, Denmark  
April 2016

Vincent F. Hendricks  
Pelle G. Hansen



# Testimonials

*Infostorms* uses examples and logic to offer a distinctive perspective on how everyday activities combined with public information may manipulate our actions, our opinions, or our choices of what to buy or sell. Their examples illustrate notions ranging from social proof, information cascades, opinion bubbles, pluralistic ignorance, framing and polarization effects, and bystander effects. The pages are full of summaries of experimental studies, anecdotes, and simple models that challenge how we think of information, knowledge, and actions. This book should be read by everyone interested in network formation and researchers interested in decision-making behavior.

—**Robert A. Becker**, Professor of Economics, Indiana University, Bloomington

Informed, fair decision-making is not a fixed virtue that a democratic society acquires once and for all, it is a process that constantly needs rethinking and reshaping under

changing circumstances. This highly original book brings the latest insights from logic, philosophy, social choice theory, cognitive psychology, and game theory to bear on the vast information streams that drive our lives. Its innovative, unified perspective sensitizes the reader to the many informational whirlpools that can make us, and our societies, spin out of control, and it makes us better equipped to cope with them. The result is a showpiece of socially responsible fundamental science.

—**Johan van Benthem**, Professor of Logic and Philosophy, University of Amsterdam and Stanford University

Hendricks and Hansen alert us to a gathering storm—the *Infostorm*—that threatens to overwhelm societies with vast amounts of information used uncritically by people to form opinions and make decisions. The storm, they argue, undermines our ability to sort true from trite from tendentious and will, if unchecked, undermine our collective intelligence. With this brilliant book, we have been warned. It is up to all of us in the world today to be stewards of the common resource that is trustworthy and relevant information.

—**Adam Brandenburger**, J.P. Valles Professor of Business Economics and Strategy, Leonard N. Stern School of Business, NYU

*Infostorms* is a sophisticated and accessible investigation into the crucial information flows that shape and govern so many aspects of our social, economic, and political lives. It elegantly manages to select crucial results in a variety of technical fields, from logic to game theory, from economics to psychology, and make them cast new and much-needed light on the infosphere. An interdisciplinary *tour de force* not to be missed.

—**Luciano Floridi**, OII’s Professor of Philosophy and Ethics of Information, University of Oxford and Fellow of St Cross College, Oxford

Modern man doesn’t need more news—he needs better news. And journalists should learn that information is no longer a scarce resource. We all drown in the polluted information surrounding us. What people need is a means of navigation, meaning, and alignment. *Infostorms* is a thoughtful, well-written and scary warning to every media organization: Change!

—**Ulrik Haagerup**, Executive Director of News, Danish Broadcasting Company

We live in environments that are rich in information, sound-bites, and noise. Our highly connected social networks facilitate the transmission of information, but can also contribute to the spread of misinformation and even disinformation. To build strong democracies and flourishing liberal societies, we must understand how our information environments function and what challenges and opportunities they generate. Written by two scholars with a strongly interdisciplinary orientation, this book brings together insights from many different academic fields to shed light on the mechanisms underpinning information flows in society and how we might respond to them. It is a highly recommended read for social scientists and concerned citizens alike.

—**Christian List**, Professor of Political Science and Philosophy, London School of Economics

This is an unusual book with a wonderful collection of social phenomena that involve logical reasoning with important notions such as knowledge, information, and beliefs. I was particularly impressed by the nice balance between intrigu-

ing stories, formal analysis, and the insights conveyed by the authors. I am sure that readers will be enlightened by this book.

—**Fenrong Liu**, Professor of Logic, Tsinghua University, Beijing

Relying on a variety of disciplines, tools and traditions, *Infostorms* provides a very exciting and disconcerting analysis of the powers, which must be scrutinized by all who are concerned about the quality, and future of our democratic systems. We are blown away by storms of alleged information ...

—**Mogens Lykketoft**, President of the United Nations General Assembly presiding over the 70th session of the General Assembly, 2015

A highly readable book, *Infostorms* is aimed as much at “students” in the broad sense as those at the university. It is sure to provoke wide-ranging discussions in classrooms. In addition, its themes and examples suggest new research questions. All in all, it is an important contribution to the social sciences for both academia and the public.

—**Lawrence S. Moss**, Professor of Mathematics, Indiana University Program in Pure and Applied Logic

This is a delightful book and deserves to be read by everyone who wants to understand our information-saturated twenty-first century. It is written in a light and breezy tone, with amusing examples, but manages to cover an enormous amount of ground. The points made by the authors explain when democracy works, and when it does not. I have already given copies of the first edition to several friends and look forward to the second.

—**Rohit Parikh**, Distinguished Professor, Computer Science, Mathematics, Philosophy, City University of New York

We now make our democratic decisions, as we live our everyday lives, buffeted by gales of purported information that are stronger and more wayward than any previous generation has had to weather. Drawing on many different disciplines and traditions, *Infostorms* offers an analysis of these forces that is indispensable for everyone who is invested, as we all should be, in the value and the future of democracy.

—**Philip Pettit**, L.S. Rockefeller University Professor of Politics and Human Values, Princeton University; University Distinguished Professor of Philosophy, Australian National University

Every few days, another digital tsunami passes through the global Web. Hendricks and Hansen bring a clear, structured understanding of how this happens and its impact on society. A structured analysis of how network effects turn small ideas into digital tsunamis.

—**Andreas Ramos**, Former Manager of Global SEO at Cisco, Palo Alto

We're all familiar with the idea that without a well-informed electorate, democracy is doomed. But what does this mean today? At the same time, advances in technology are profoundly changing how we receive and share information, science is providing startling new insights into how the mind works, and the predictable pathways that lead us to behave irrationally. Fortunately for us, Vincent F. Hendricks and Pelle G. Hansen can explain and integrate what's happening on both cutting-edge fronts. Their highly original and lucid text is an indispensable guide for making sense of the present and securing the future.

—**Evan Selinger**, Professor of Philosophy, Rochester Institute of Technology



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**Pelle Guldborg Hansen** is a researcher on behavior at Roskilde University; Director of ISSP—The Initiative of Science, Society and Policy at Roskilde University and the University of Southern Denmark; and a member of the Prevention Council of the Danish Diabetes Association. He also heads the independent research group iNudgeYou, and is chairman of the Danish Nudging Network and co-founder of TEN—The European Nudge Network.

# Chapter 1

## Off We Go

### Why More Information Does Not Get Us Closer to the Truth

*The information in the world doubles every day.  
What they don't tell us is that our wisdom is cut in half at the same time.*

—Joey Novick

## 1.1 Social Psychology on Speed

“I don’t get swung by what other people have to say about this and that; I get information from a variety of sources, weigh the pros against the cons, triangulate intelligence, ask some more questions to peers and public, counterbalance positive and negative reviews online, analyze the evidence, and then equitably and without emotion deliberate, decide, and act for myself. I do so all the time; it doesn’t matter whether we’re talking about the routine of selecting my new cell phone or which party to vote for in the next election. That’s all I have to say about that!”

Unfortunately, that's not all there is to say about that, even though the information age provides virtual oceans of information. First of all, information on which trivial as well crucial decisions are based may be tampered with, and second, personal belief, deliberation, decision, and action are influenced by what other people think or do. The aggregated opinion of others may influence our personal viewpoints. A paper was recently published in *Science* (Muchnik et al. 2013) that described an experiment on a social news aggregator platform and online rating system, the result of which testifies to massive social influence bias on individual users. On an unidentified crowd-based opinion aggregator system ostensibly “similar to Digg.com and Reddit.com,” the status of 101,281 comments made by users over a five-month period with more than ten million views and rated 308,515 times, was monitored. In collaboration with the service, the researchers had rigged the setup in such a way that whenever a user left a comment, it was automatically rendered with either a positive “upvote,” a negative “downvote” or no vote at all for control. Now, here is a key to the experiment: If a comment received *just a single* upvote, the likelihood of receiving another upvote for the first user to see it was 32 % relative to the control group. Additionally, chances were higher that such comments would proliferate in, or lemming to, popularity, as the upvote group had on average a 25 % greater rating than the control group. One of the lessons from this experiment is that

“... attempts to aggregate collective judgment and socialize choice could be easily manipulated, with dramatic consequences for our markets, our politics, and our health.”  
(Muchnik et al. 2013: 351)

It is hardly news that others influence us, and it is hardly news that we are susceptible to social information phenomena

like herding, lemming-effects, bystander-effects, group-thinking, collective boom-thinking, majority mistakes, etc. But it *is* news that modern information technologies have magnified and amplified phenomena for which social information processes threaten to distort truth, making us more at risk to err than ever before, and on a much larger scale. The abundance of information driven by technologies such as computers, the Internet and, in particular, the social media, has forced us to increasingly rely on information technologies that cut short traditional cumbersome search processes that cannot cope with the plenitude of available information, as well as offering tempting avenues for bypassing the traditionally slow gate-keepers of truth and validation. Relying more and more on social media, crowd-based opinion generators, and other online “democratic” ratings, comments, or information acquisition systems not only make such side-tracking possible and more likely to occur, it also increases the numerical, if not the proportional, reach of the spreading of false beliefs and consequences thereof—intentionally or not. When information spreads in this way without tracking the truth, the resulting phenomenon is referred to as an “infostorm.”

*Infostorms* is about social psychology on speed. Again, while the social information phenomena magnified by such technologies have always existed, they now take on proportions of reach and celerity with possible severe consequences for the democratic institutions underpinning the information societies we live in. The more we uncritically rely on automatic information technologies, the more likely it is that the consequences will go unnoticed, sometimes with absurd and even lethal results.

While the described experiment perhaps doesn’t have severe consequences for our democratic institutions, it exemplifies what may happen to the reflection of truth when we solicit our decision-making power to, and rely unconditionally on,

information technologies and processes. In other cases, the result of committing to such processes may expatriate information phenomena that track truth imperfectly in ways that give us reasons to believe the truly unbelievable, and stick to what turns out bogus information because we think everybody else thinks so—and, in turn, neglect true knowledge.

## 1.2 Information vs. Knowledge

It is often claimed that the information age, with its crowd-based information aggregators, has “democratized” knowledge. But knowledge and information are not the same.

Plato had a hard time with democracy because truth can't be determined by majority vote. The number of articles, the number of information sites and of individuals who read and contribute to them do not as such guarantee the truth of the information passed along by social media and crowd news, opinion, and rating dynamos. Plato was also aware of the essential difference between information and knowledge. By way of example, you may be *informed*, or convinced, of the world being ruled by narrow-minded vested financial interests *without* knowing it. But if you *know* the world is ruled by narrow-minded money-vested interests, you are also informed of this. *Knowledge implies information, but information doesn't necessarily imply knowledge.* In particular, knowledge is required to track the truth, but no such relationship is required for belief, conviction, or information. Whatever the majority thinks, hopes for, or feels, or what the population-at-large is informed of, does not fix tracking the truth. The way in which information is *processed* when tracked presents the crucial difference between knowledge and information. In short: *knowledge = reliable process + true information.* The capabilities and information dynamics of the crowd are not always a reliable knowledge-acquisition process.

The good thing about knowledge is that even though it might be a real hassle to obtain, it does stick and may then be used for deliberation, decision, and action with respect to a variety of different problems. The bad thing about knowledge is that one must not only acquire true information, but also get to know the tools in the toolbox, and that may yet again be a challenge of hardship. But that's just too bad: *knowledge is contrary to, for instance, easily obtained copy-pasted information or socially aggregated opinion, not democratic, but a hard-earned regime.*

It's a different story with information—even true information. It may be procured easily, quickly, and cheaply. The problem, however, is that we can't just solve climate problems, the challenge in the Middle East, severe cyber-bullying, or democratic disagreement, no matter how many we are or how quickly we may compile and read articles, entries, comments, and their up- or downvotes on the Web. Some, as in the above-mentioned paper from *Science*, may hijack popular opinion by manipulating the up-vote in the beginning of a thread, or many may coincidentally just happen to share the same view at the same time, and jack it up further by additional ratings. So even with true information at hand, this neither guarantees a solution to the problems we face nor ensures that there is anything correct about the positive consensus we may end up with; rather, to solve such problems we must venture down the knotty road of knowledge.

The shibboleth of the Age of Enlightenment was *sapere aude* (dare to know). The expression implied that if something was not downright dangerous, it was at least challenging and labor-intensive to obtain knowledge. Knowledge is not something one herds; it is something one *acquires*, and that's precisely why one cannot equate knowledge with information.

The American physicist and priest, William Pollard, is quoted as having said:

“Information is a source of learning. But unless it is organized, processed, and available to the right people in a format for decision-making, it is a burden, not a benefit.”

Similarly, Mitchell Kapor, the founder of the Lotus Development Corporation, is reported to have proclaimed that:

“Getting information off the Internet is like taking a drink from a fire hydrant.”

It's so easy to hoard information these days, but it by no means follows that decisive decisions have become easier to make, or that apprehension and insight may be taken for granted by the mere quantity of information. In fact, the abundance of information has made it harder to track the truth and dispense with the false. Organizing, tracking, and formatting information correctly—as required for knowledge-based decision proficiency—requires tools, assessment, evaluation, and the audacity the thinkers of the Enlightenment spoke of.

This may seem paradoxical, however. Had Spinoza, Kant, and the other Enlightenment philosophers predicted that all their efforts would end in an “Age of Information” where free and savvy citizens are exceedingly susceptible to social influence, crowd-heaped points of view, and opinion bubbles, they might have ended up dreaming of the spirit and times of the dark Middle Ages, which they had worked so hard to rid society of.

Former U.S. Ambassador to the United Nations and sociologist, Daniel Patrick Moynihan, is purported to have said: