Vivre avec l'incertitude

Alexei Grinbaum

CEA-Larsim
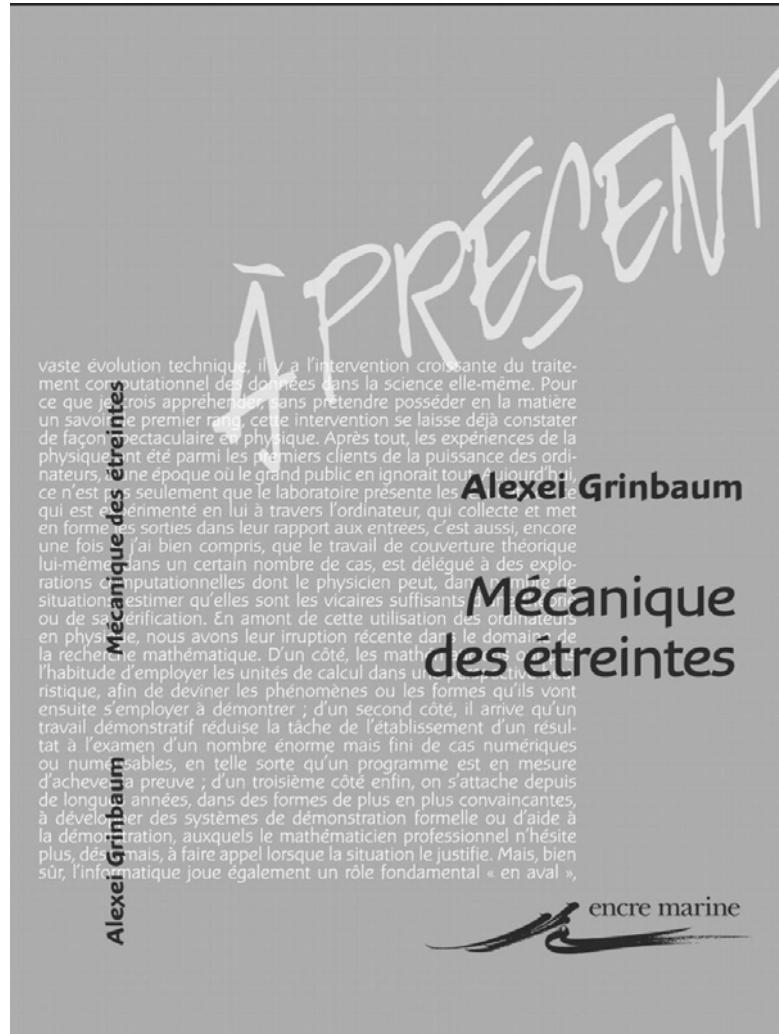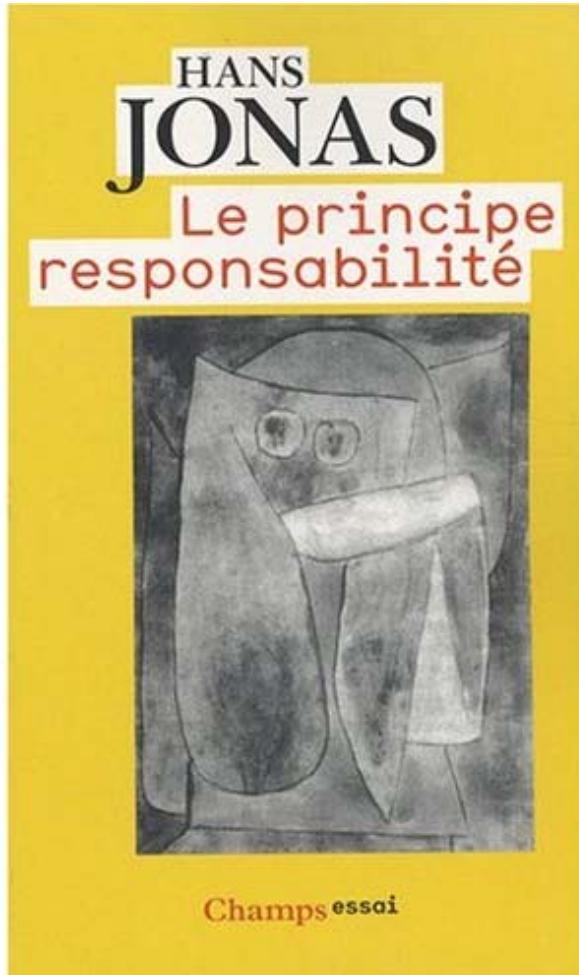
Aujourd'hui, la puissance humaine et son excédent par rapport à toute préconnaissance certaine des conséquences ont pris de telles dimensions que le simple exercice quotidien de notre pouvoir, qui constitue la routine de la civilisation moderne – et dont nous vivons tous –, devient un problème éthique.

The Economist

DECEMBER 19TH 2009–JANUARY 1ST 2010   Economist.com

Turmoil at British Airways

Greece on the edge

Wall Street v London v Shanghai

China's control freaks

Progress and its perils

Plenty of eyes at the bottom

Nanotechnology will make it easier for governments and companies to invade the privacy of citizens and customers, warns **Chris Toumey**.

to do anything.

One way to anticipate interactions between nanotechnology and privacy is to recall earlier instances of privacy concerns, and how people responded. There is a well-established constellation of values and concerns, including fear of the powers of large impersonal organizations. We can hypothesize that some patterns of peoples' experiences and concerns are more likely than others, and that nanotechnology will be nested within those patterns.

PRIVACY AND TECHNOLOGY

The historian Joyce Li traces the origin of privacy policy in the US to the Post Office Act of 1710, enacted by British authorities, which was meant to end the common practice of people reading other people's mail. The US Post Office Act of 1825 empowered the government with strong measures to protect the integrity of the mail, and that law is still in effect today. During the Cold War years, several factors made threats to privacy seem especially acute, including mistrust of the government and its large computers (which were novel at the time). Concerns

In the history of technology, reacting after the event usually means reacting too late to do anything.

It is frequently difficult or impossible to redact all erroneous information. The parts of our lives that are vulnerable to such breaches include credit-card purchases, bank accounts, medical records, lab tests, library records, website contacts, internet searches, records of phone calls (where the call was made and who was called), plus many more.

Computer-based dangers to privacy have been further complicated by national security policies after 9/11. The Bush administration has often adopted the broadest possible readings of the 2001 Patriot Act to give the President unlimited powers during the war on terrorism. Several court decisions have constrained the administration's policies, but the post-9/11 situation puts the ethos of national security in sharp conflict with the protection of privacy. In the UK, the Terrorism Act allows the police

might sound good, but who else will have that information about where we have been?

Another cause for concern is the molecularly naked patient. Nanoscale cantilevers and other devices can record diagnostic information with molecular precision, which could allow insurance companies to know more about our bodies than we do. There are already worries about genetic discrimination, and nano-enabled diagnostic devices will only amplify these worries. If the use of nano-diagnostics is tantamount to loss of privacy, then people may feel they have to choose between privacy and medical care.

Such a choice is sad and ironic. One of the more optimistic themes of nanomedicine is the potential for personalized medicine: highly sensitive diagnostics will lead to highly sensitive therapies. However, this means that diagnostic information about the molecules in one's body must be compared with the same kind of information about other people — but it will only be possible to do this by storing vast amounts of personal medical information in large centralized systems.

Principe de précaution

N° 2719

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ASSEMBLÉE NATIONALE

CONSTITUTION DU 4 OCTOBRE 1958

TREIZIÈME LÉGISLATURE

Enregistré à la Présidence de l'Assemblée nationale le 8 juillet 2010

RAPPORT D'INFORMATION

FAIT

AU NOM DU COMITÉ D'ÉVALUATION ET DE CONTRÔLE DES POLITIQUES PUBLIQUES
SUR *l'évaluation de la* mise en œuvre *de* l'article 5 de la Charte de
l'environnement relatif *à* l'application *du* principe *de* précaution

par

MM. ALAIN GEST ET PHILIPPE TOURTELIER,

Députés.

—

« LE POINT D'ORGUE NATIONAL D'UNE ÉVOLUTION JURIDIQUE ET POLITIQUE INTERNATIONALE »

Incertitude
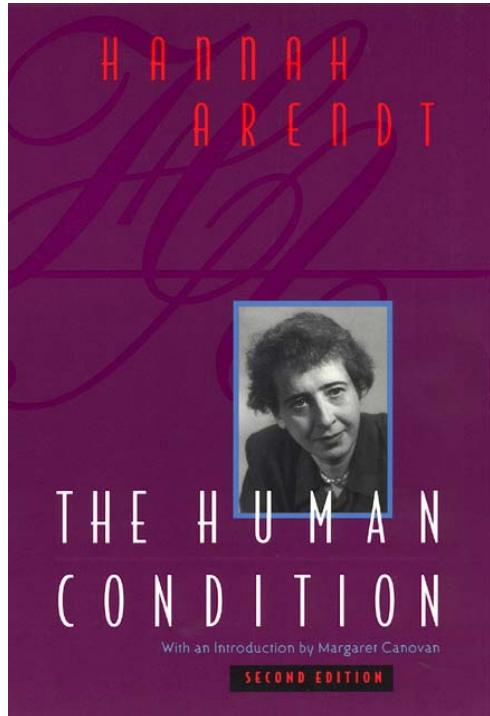
"Processes are started whose outcome is unpredictable, so that **uncertainty rather than frailty becomes the decisive character of human affairs**."

Risque: les probabilités et la taille des dommages possibles sont connues.

Incertitude: les niveaux des dommages sont connus, mais pas les probabilités.

Ambiguïté: la mesure ou la caractérisation des dommages est floue, il y a un désaccord sur ce qui constitue un dommage.

Ignorance: la connaissance des conséquences est incomplète. On "ne sait pas qu'on ne sait pas", d'où la possibilité de surprise.

Indétermination: différentes contextualisations sociétales dépendent de façon réflexive des interactions complexes et des chemins de co-évolution des systèmes sociaux, techniques et naturels.
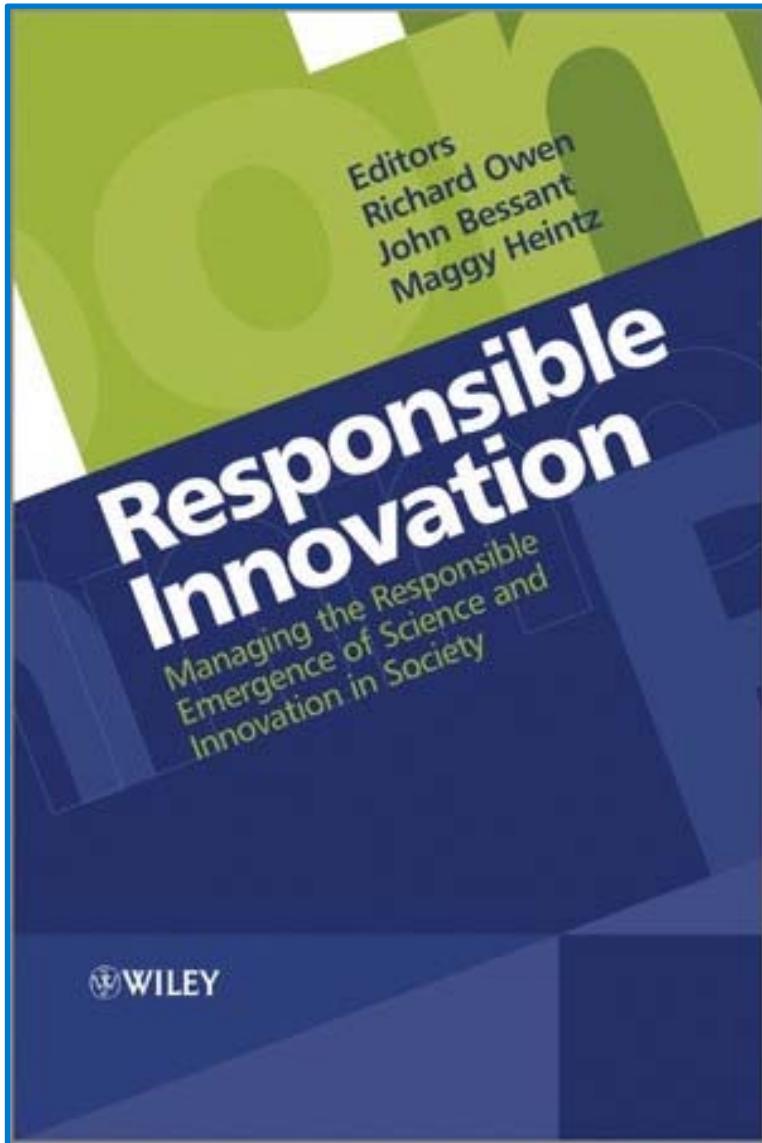
La société semble exiger que les technologies et les chercheurs individuels soient certifiés comme étant entièrement innocents et incapables de provoquer un aléa.

Les scientifiques exaspérés répliquent :
« Il n'y a pas d'innovation sans risque, alors acceptez les risques si vous souhaitez bénéficier des nouvelles technologies ! »

Alexei Grinbaum (CEA/LARSIM)

Editors
Richard Owen
John Bessant
Maggy Heintz

Responsible Innovation

Managing the Responsible
Emergence of Science and
Innovation in Society

WILEY
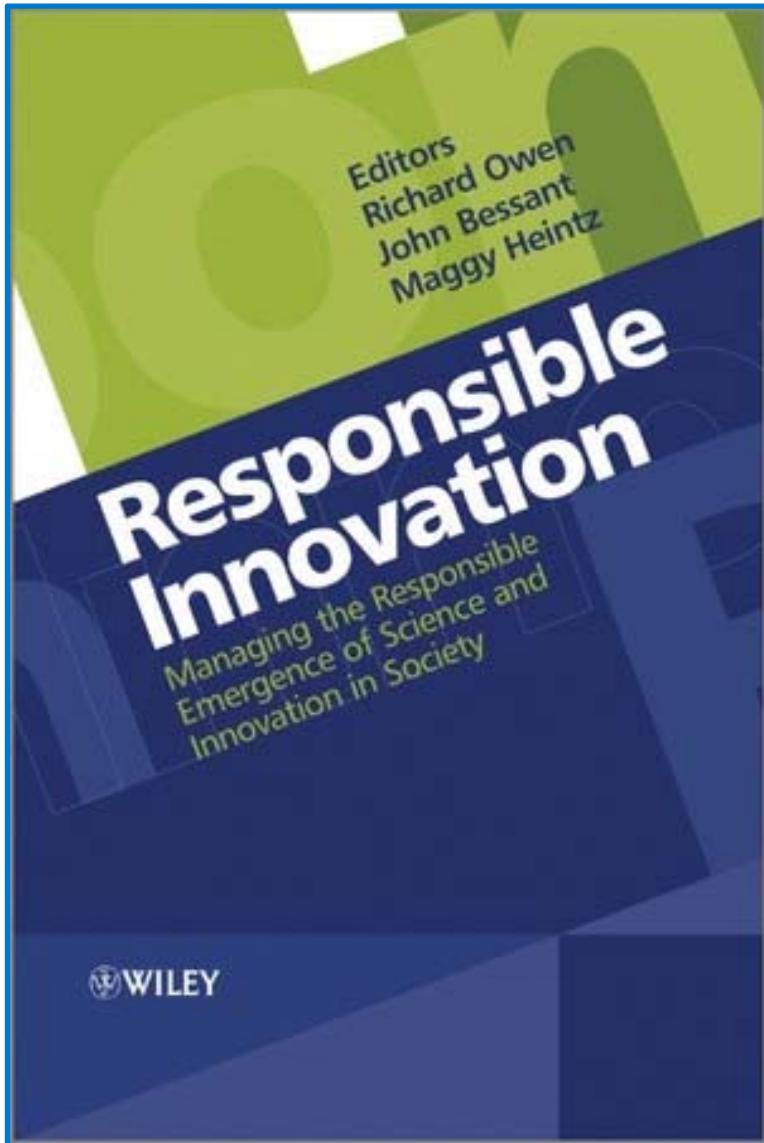
Or ce n'est pas la question :
suite aux « affaires » liées aux
nouvelles technologies
(Tchernobyl, Fukushima, sang
contaminé, etc.) et au trauma
qu'elles ont engendré, les
déclarations expertes sur
l'équilibre entre bénéfices et
risques ne font plus foi.

L'émotion et la passion
deviennent source et
justification du jugement.

Alexei Grinbaum (CEA/LARSIM)

**Jamais on n'a appris
ni entendu dire,
et jamais l'oeil n'a
vu...**

Isaïe 64:4

Evénements uniques

**Ce sont des choses que
l'oeil n'a point vues,
que l'oreille n'a point
entendues...**

1 Corinthiens 2:9

1

2

observateur

système observé
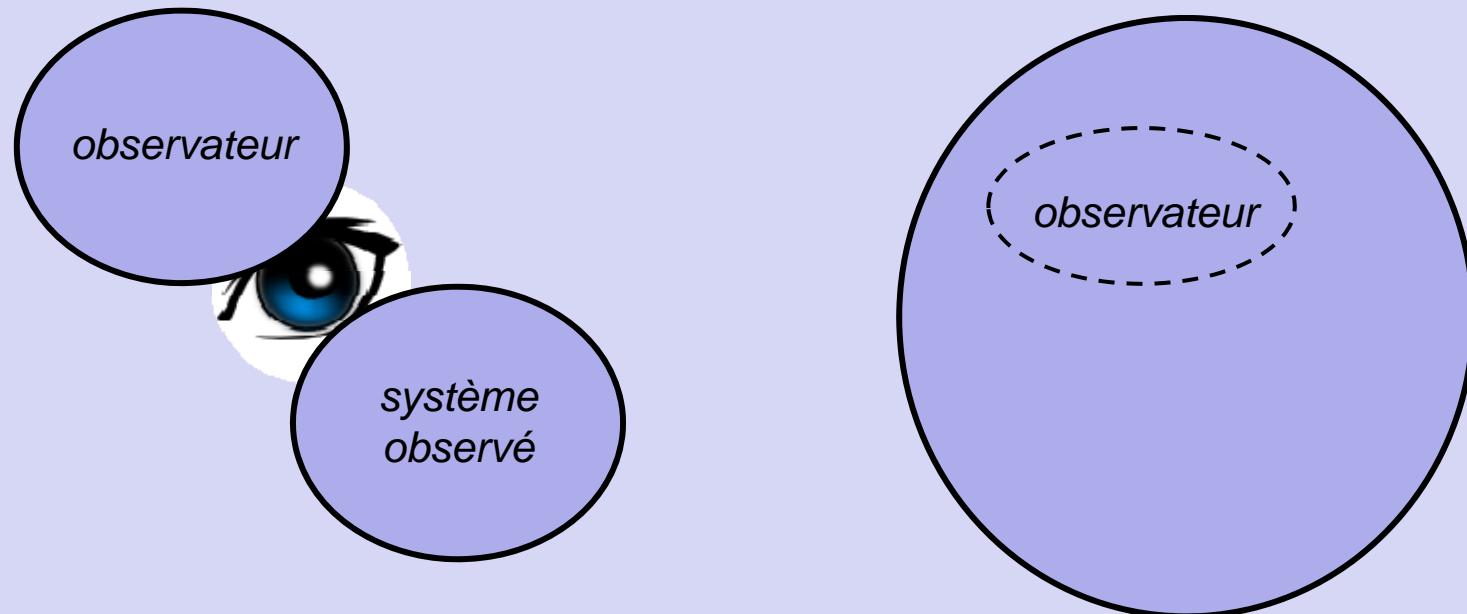
observateur

Théorème de Breuer :
Tout observateur intérieur au
système a l'accès à une
information incomplète sur
l'état du système qu'il observe
de l'intérieur.

Principe inverse de l'évaluation des risques :
La propension de la communauté de reconnaître l'existence d'un risque dépend du degré de croyance de cette communauté en l'existence des solutions.

D. Fleming

3

L'origine des barrières cognitives :
La façon de poser ("to frame") un problème a une influence forte sur la manière de le résoudre.

Amos Tversky et Daniel Kahneman

The certainty effect

Problem 1: Choose the option you prefer:

❖ a sure win of $30
❖ 80% chance to win $45

The certainty effect

➡ **Problem 1**: Choose the option you prefer:

❖ a sure win of $30   **[78%]**
❖ 80% chance to win $45   **[22%]**

Problem 1: Choose the option you prefer:

> ❖ a sure win of $30   **[78%]**
> ❖ 80% chance to win $45   **[22%]**

➡ **Problem 2**: Consider the following two-stage game. In the first stage, there is a 75% chance to end the game without winning anything, and a 25% chance to move into the second stage. If you reach the second stage you have a choice between:

> ❖ a sure win of $30
> ❖ 80% chance to win $45

Your choice must be made before the game starts. Choose the option you prefer.

Problem 1: Choose the option you prefer:

    ❖ a sure win of $30   **[78%]**
    ❖ 80% chance to win $45   **[22%]**

➡️ **Problem 2**: Consider the following two-stage game. In the first stage, there is a 75% chance to end the game without winning anything, and a 25% chance to move into the second stage. If you reach the second stage you have a choice between:

    ❖ a sure win of $30   **[74%]**
    ❖ 80% chance to win $45   **[26%]**

Your choice must be made before the game starts. Choose the option you prefer.

Problem 1: Choose the option you prefer:

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  ❖ a sure win of $30   **[74%]**
  ❖ 80% chance to win $45   **[26%]**

Your choice must be made before the game starts. Choose the option you prefer.

➡ **Problem 3**: Choose the option you prefer:

  ❖ 25% chance to win $30
  ❖ 20% chance to win $45

Problem 1: Choose the option you prefer:

❖ a sure win of $30   **[78%]**
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❖ a sure win of $30   **[74%]**
❖ 80% chance to win $45   **[26%]**

Your choice must be made before the game starts. Choose the option you prefer.

➡ **Problem 3**: Choose the option you prefer:

❖ 25% chance to win $30   **[42%]**
❖ 20% chance to win $45   **[58%]**

Compare 1 and 3

Problem 1: Choose the option you prefer:

- ❖ a sure win of $30   **[78%]**
- ❖ 80% chance to win $45   **[22%]**

Problem 3: Choose the option you prefer:

- ❖ 25% chance to win $30   **[42%]**
- ❖ 20% chance to win $45   **[58%]**

**Certainty exaggerates the aversiveness of losses
that are *certain* relative to losses that are merely *possible* –
the certainty effect**

Alexei Grinbaum (CEA/LARSIM)

Compare 2 and 3

Problem 2: Consider the following two-stage game. In the first stage, there is a 75% chance to end the game without winning anything, and a 25% chance to move into the second stage. If you reach the second stage you have a choice between:

- ❖ a sure win of $30   **[74%]**
- ❖ 80% chance to win $45   **[26%]**

Problem 3: Choose the option you prefer:

- ❖ 25% chance to win $30   **[42%]**
- ❖ 20% chance to win $45   **[58%]**

Certainty in 2 is illusory as the gain is contingent upon reaching the second stage of the game. This is a pseudo-certainty effect or the effect of contingent certainty.

Alexei Grinbaum (CEA/LARSIM)

Aversion à la non-connaissance

Paradoxe d'Ellsberg

Urne A:
7 noires,
7 rouges
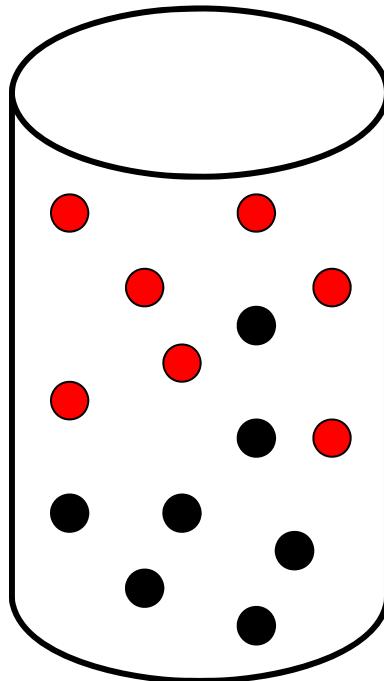
Urne B:
14 balles
au total
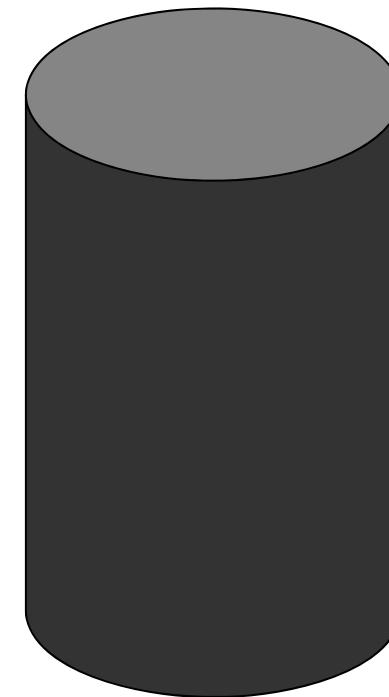
**Choisir une urne et parier sur la couleur de la balle qui en sera tirée.**

Urne A:
7 noirs,
7 rouges

Urne B:
14 balles
au total
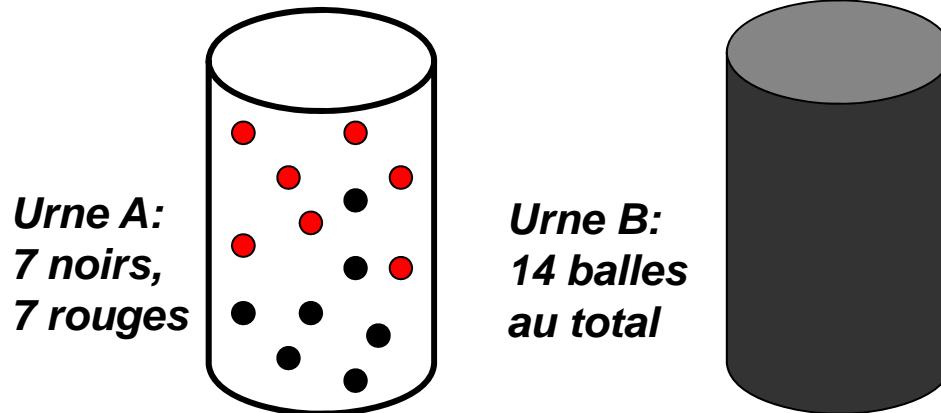
- Décision par la théorie des probabilités de Savage : choisir urne B

- Résultat d'Ellsberg: très forte préférence pour urne A

- Pourquoi ? Parce que la probabilité est connue d'avance.

Leçons du paradoxe d'Ellsberg

➢ Les décideurs humains ne sont pas des calculateurs de probabilités.

➢ L'aversion à la non-connaissance : on préfère les situations où une information est disponible quelles que soient sa qualité ou sa fiabilité.

➢ Surmonter cet effet ? Seulement si le décideur prend le temps de réfléchir à sa façon de réagir.

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HIEREMIAS
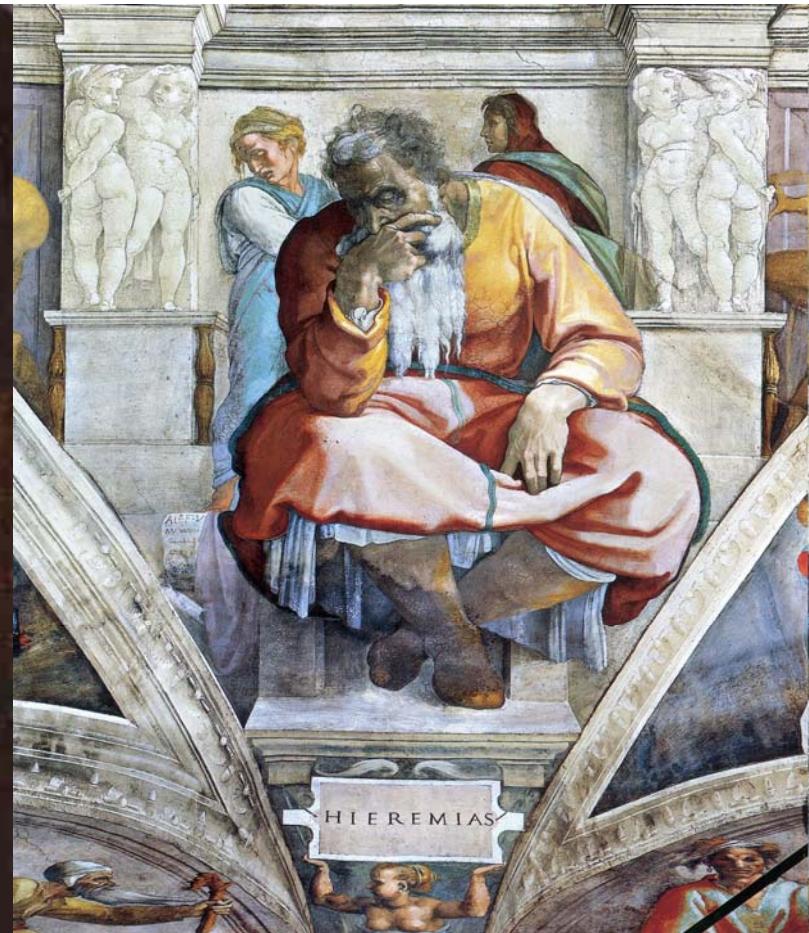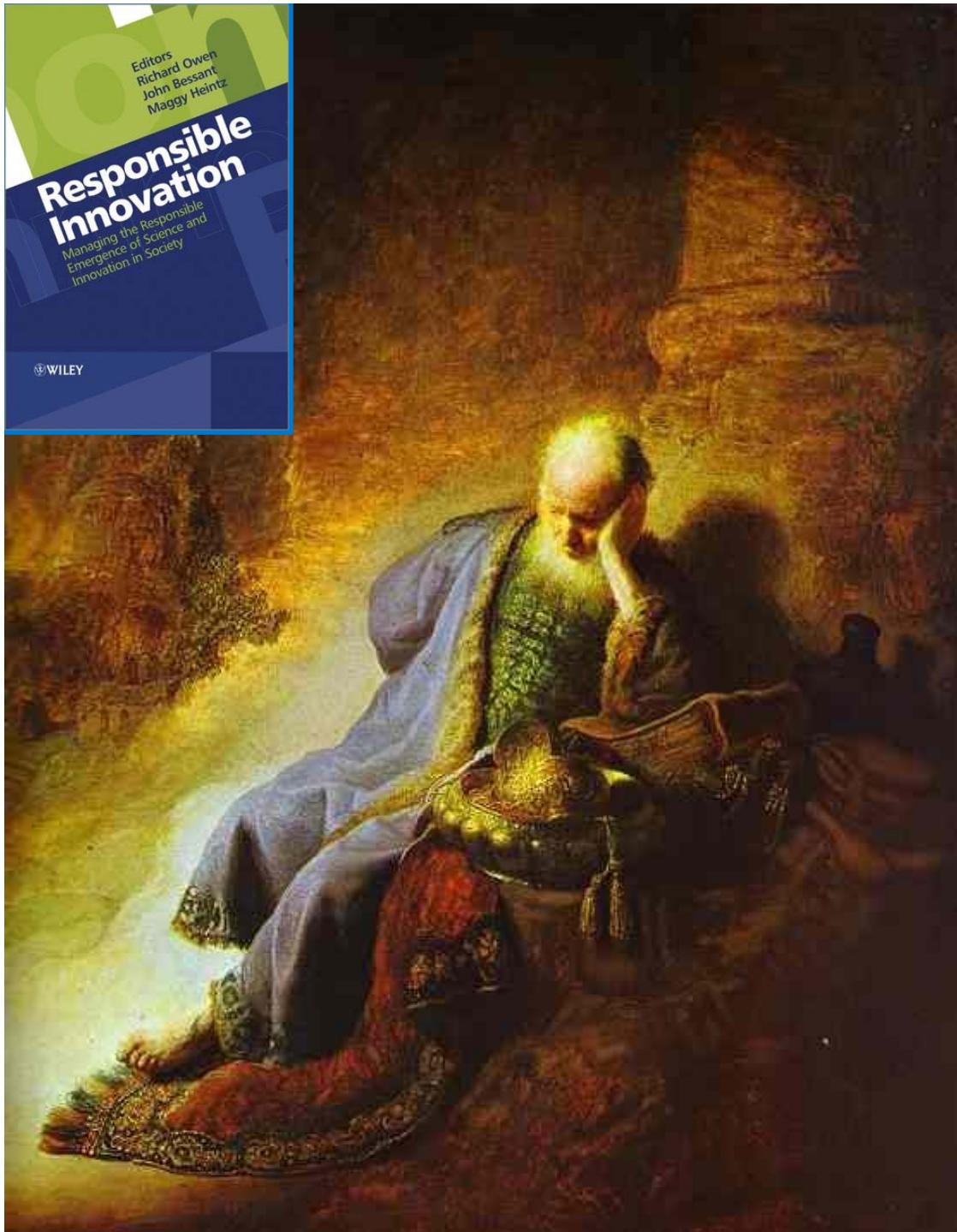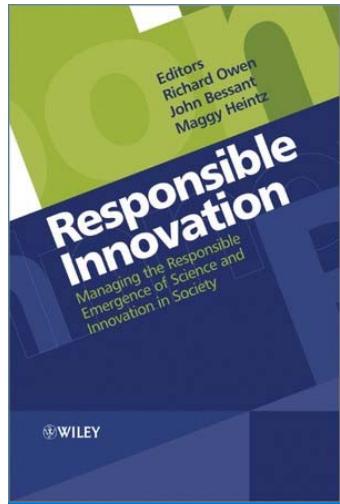
ORIGINAL PAPER

The nanotechnological golem

Alexei Grinbaum