

Exposition aux risques de catastrophes naturelles et influences comportementales : les apports de l'économie comportementale

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**1) Exploring the role of emotions in decisions involving catastrophic risks:
Lessons from a double investigation,**

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**2) Risk and time preferences under the threat of background risk: a case-study of
lahars risk in central Java,**

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Exploring the role of emotions in decisions involving catastrophic risks: Lessons from a double investigation

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OUTLINE

I BACKGROUND: Catastrophic, and emotions and decision

II FRAMEWORK: Emotions and decision under uncertainty

III INVESTIGATION: Artificial and real-life catastrophic events

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I BACKGROUND: Catastrophic risks, emotions and decision

Catastrophic risks

- A risk of large losses and a low probability of occurrence: landslides, earthquakes, floods, avalanches, hurricanes.
- High stakes: The total cost of natural disasters worldwide was €122 billion in 2012, growing almost continuously since 1970.
- World's ten most costly disasters between 1970 and 2011: five involved flooding, three earthquakes, one a hurricane, the last being the terrorist attacks on 11 September 2001 (Sigma, 2012).

Emotions

- « Positive or negative experience that is associated with a particular pattern of physiological activity » (Schacter, 2011).
- Emotions are brief in duration and consist of a coordinated set of responses, which may include verbal, physiological, behavioural, and neural mechanisms.

Catastrophic risks and emotion

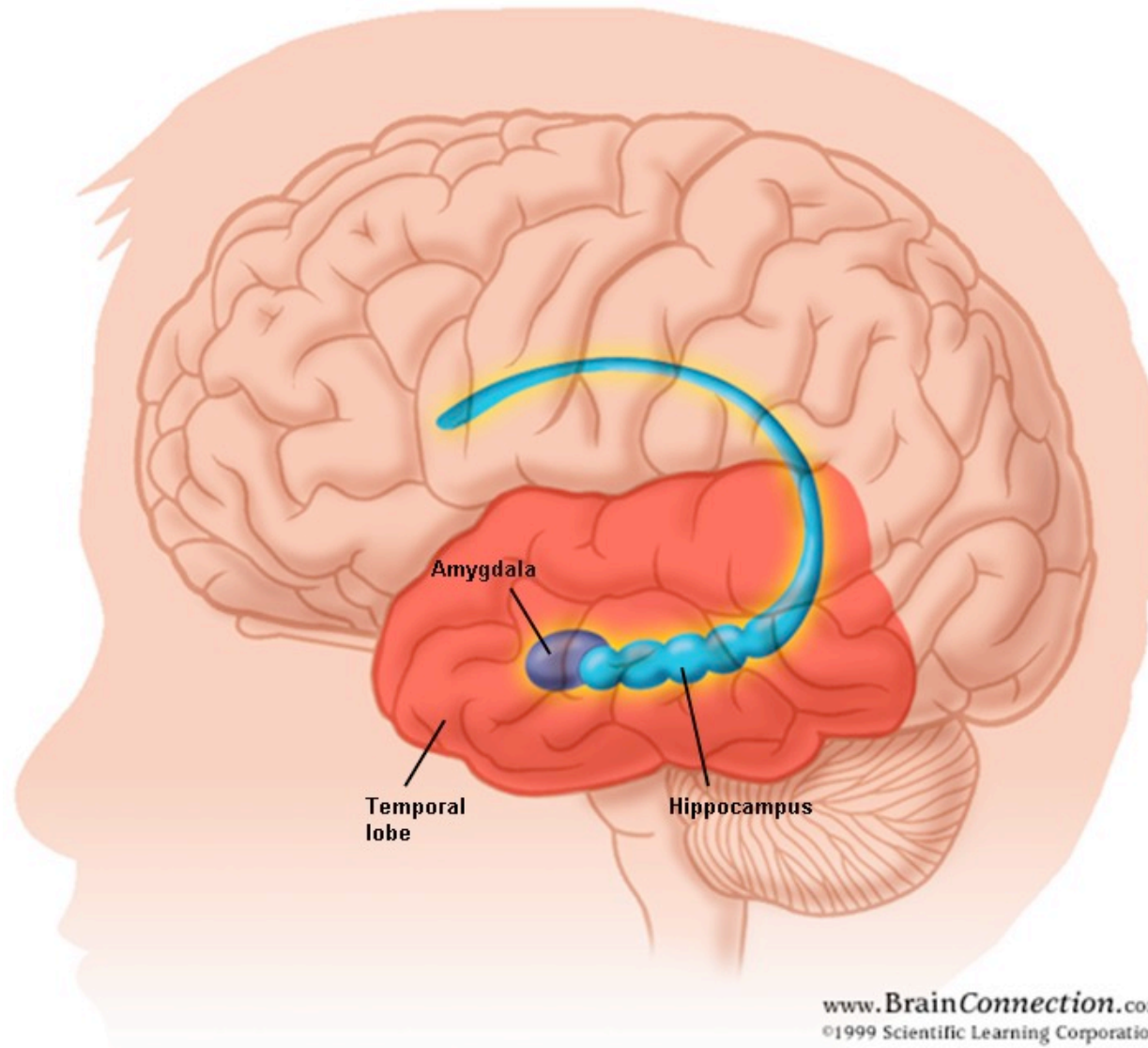
- Sunstein (2003) or Sunstein and Zeckhauser (2008) provide evidence that individuals show unusually strong reactions to low-probability catastrophes especially when their emotions are intensely engaged.
- Sunstein (2002) thinks that strong emotions like fear or regret, when associated with a catastrophic event, can lead to decisions that are not rational if the probabilities of occurrence of this event are negligible: "probability neglect".
- Viscusi (2009) finds that preventing terrorism deaths is valued by respondents almost twice as highly as preventing natural disaster deaths. He argues that terrorism risks are vivid due to the 9/11 attacks, and involve a substantial element of dread.

Catastrophic risks, emotions and decision

- Economists usually use the choice under uncertainty framework, especially the widely-applied Expected Utility (EU).
- Any observer expecting EU optimization regarding catastrophic risks will be disappointed, and will believe that there is irrationality.

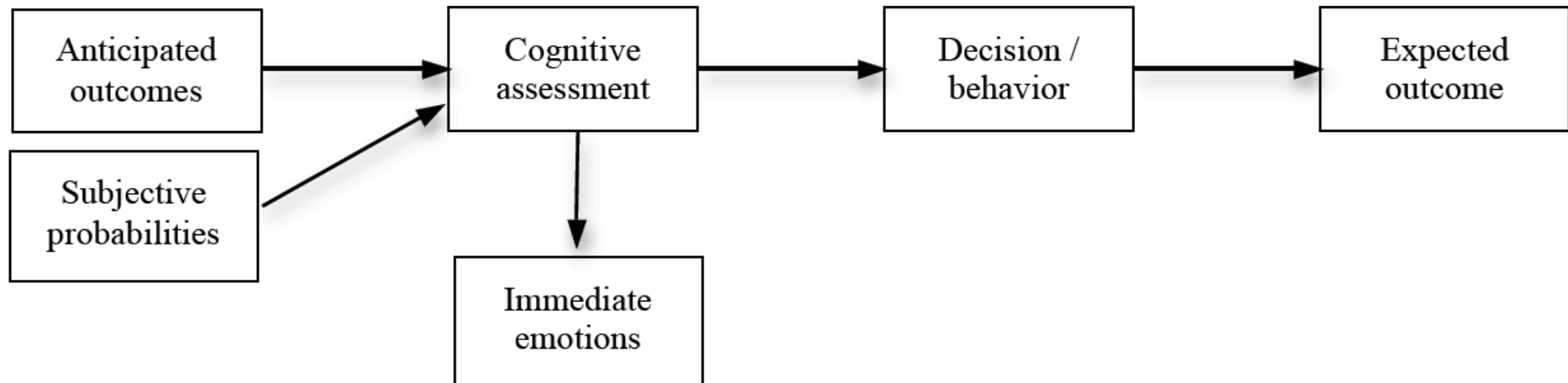
Aims of this paper

- Investigate how emotion(s) can be accounted for when guiding vulnerable populations towards more rational decisions.
- A wider look at the influence of emotions on decision, based on the Dual system (Slovic et al., 2004):
 - a fast, intuitive "emotional evaluation" that relies on emotions from the amygdala in the brain: "risk as a feelings",
 - a slower "cognitive evaluation" using logic and computation abilities from the cortex: "risk as analysis".



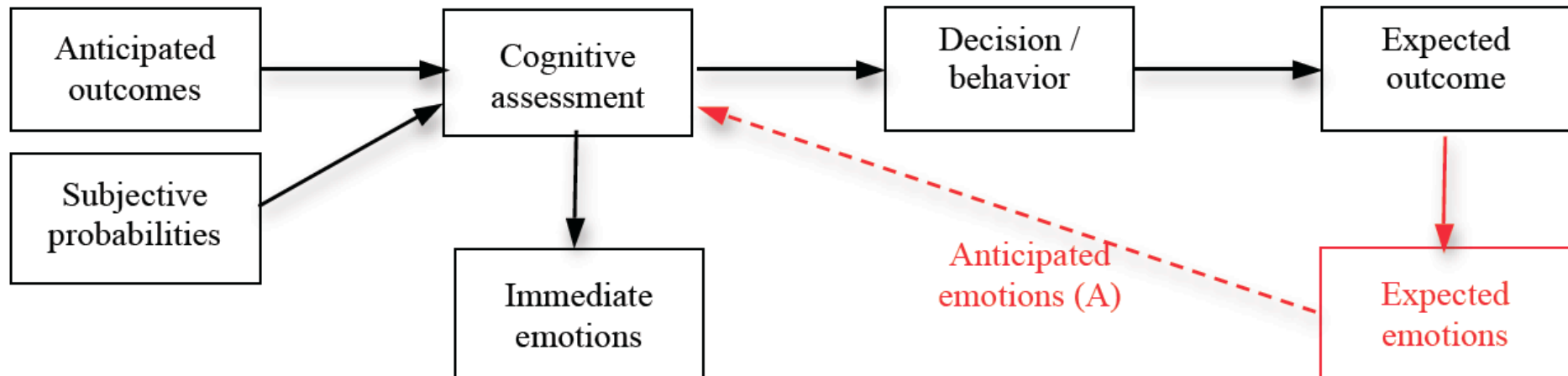
II FRAMEWORK: Emotions and decision under uncertainty

Standard representation



Almost exclusively the EU: the decision-maker has preferences over lotteries and must choose the one that maximizes his utility. The cognitive assessment phase generates immediate emotions that are only viewed as a side effect of the cognitive task.

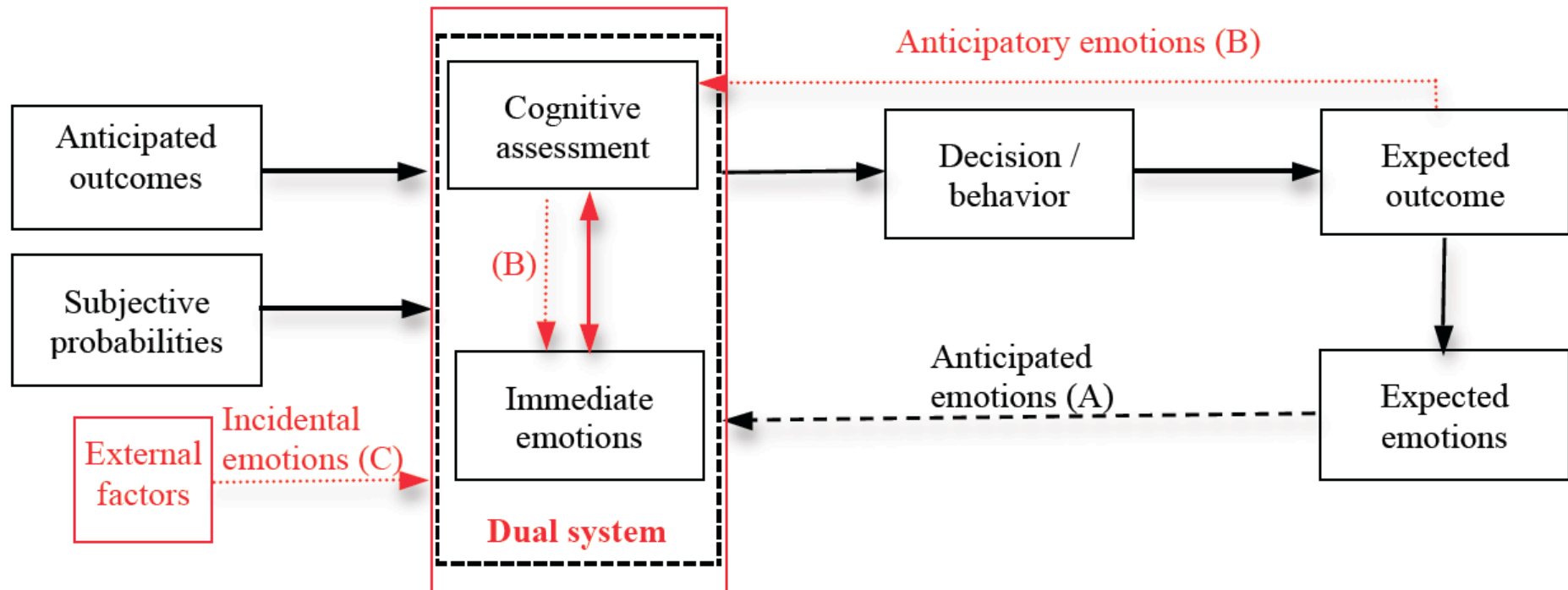
Standard representation with anticipated emotion



Expected (or Anticipated) emotions (A): By taking a decision now, the emotional state of the individual is affected by the fact that s/he imagines the emotions s/he will likely feel when the outcome is finally realized.

Ex.: Kahneman & Tversky (1979) with loss aversion, Loomes & Sugden (1982) and Bell (1982) with regret, Loomes & Sugden (1982) and Gul (1991) with disappointment.

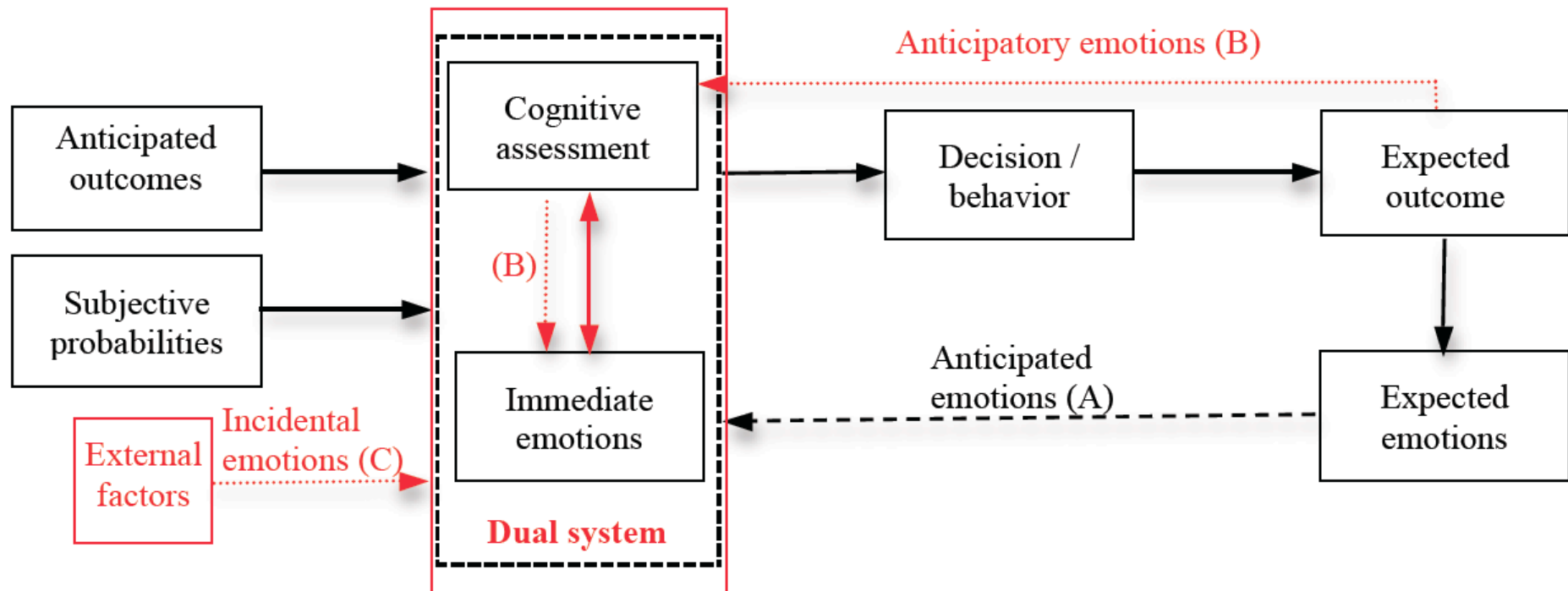
Representation of decision under uncertainty with the dual system and emotion



Immediate integral (or Anticipatory) emotions (B): Emotions felt at the time of decision-making, when we imagine future outcomes, change the cognitive assessment of the risk and its consequences through cognitive and emotional risk assessment.

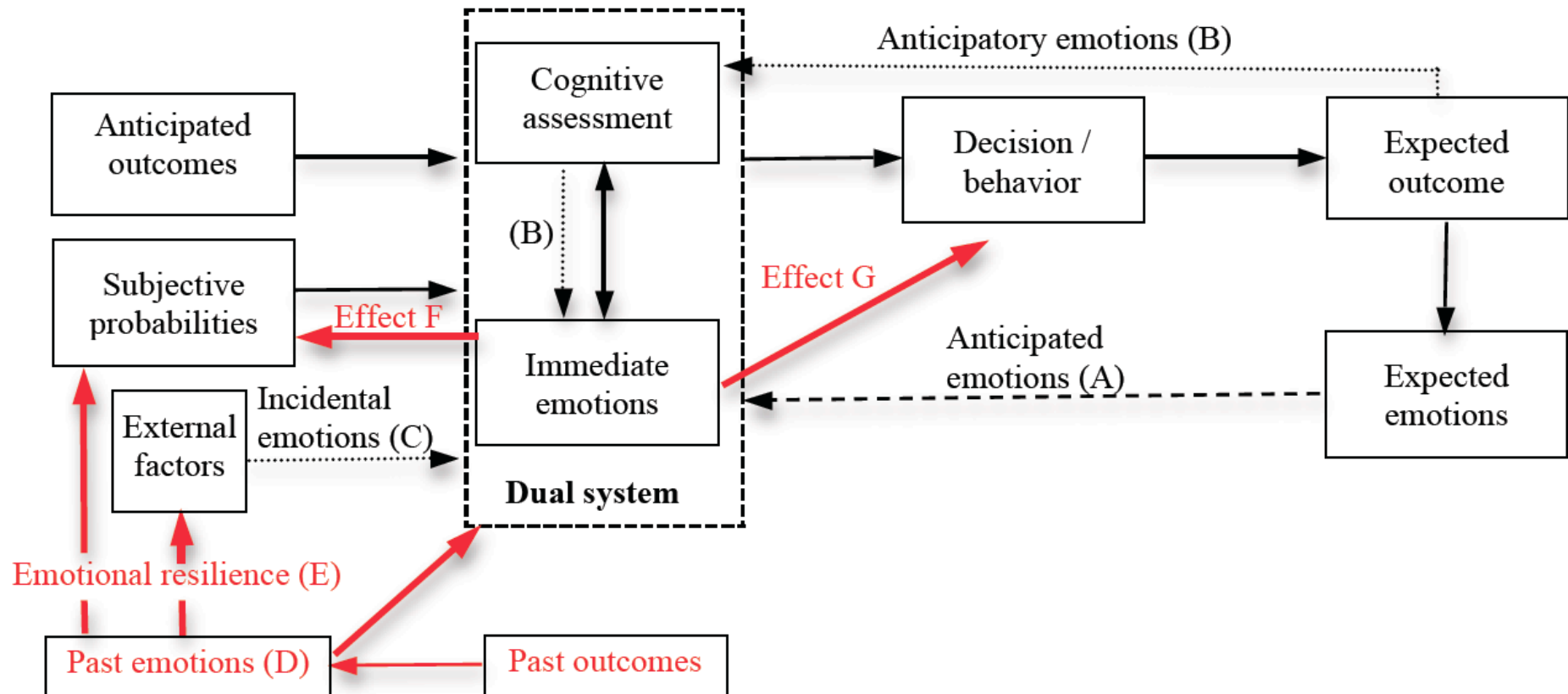
Ex: Rick & Loewenstein (2008) and Caplin & Leahy (2001).

Representation of decision under uncertainty with the dual system and emotion



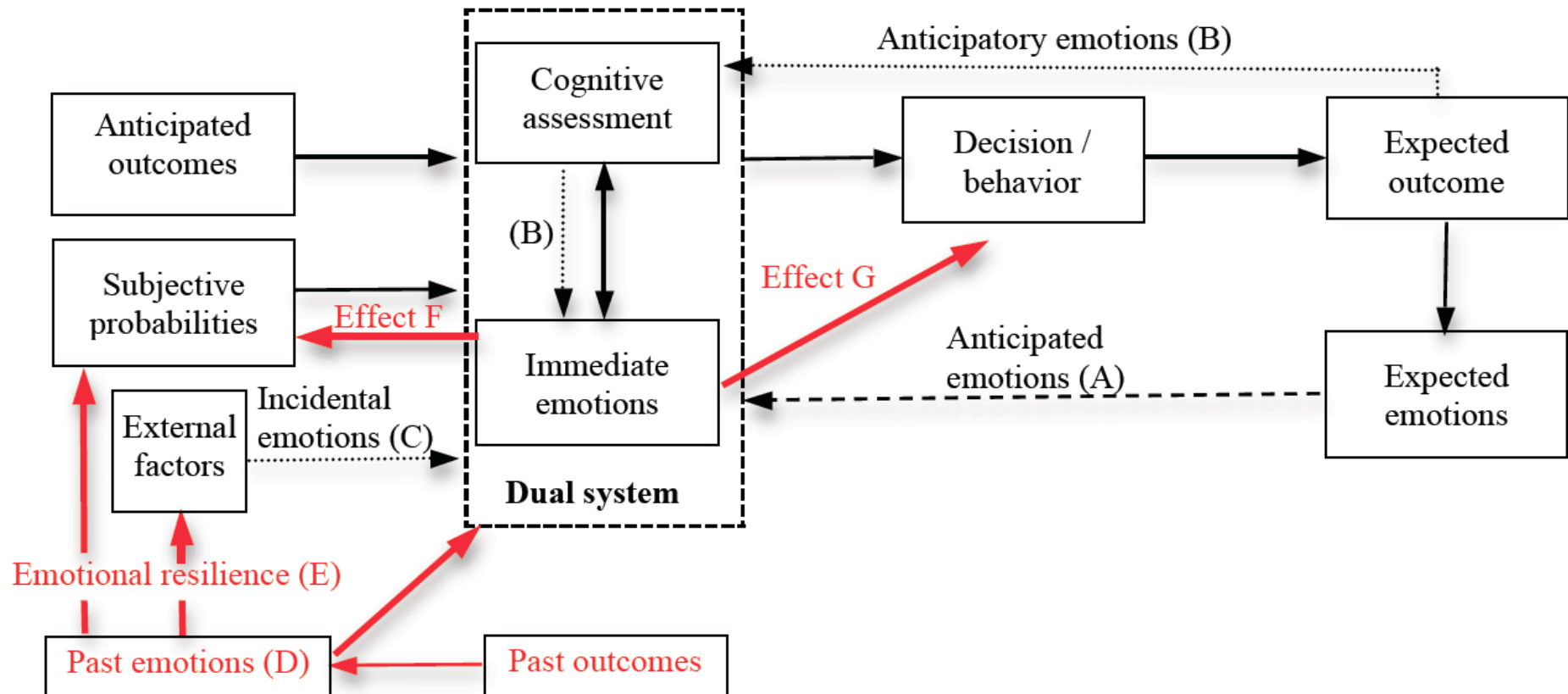
Immediate incidental emotions (C): Emotions immediately associated with current external factors not related to the decision (emotional state, mood, personality of the individual at the time of decision-making, their general perception of probabilities) are likely to affect the decision.

Comprehensive representation of decision under uncertainty with emotions



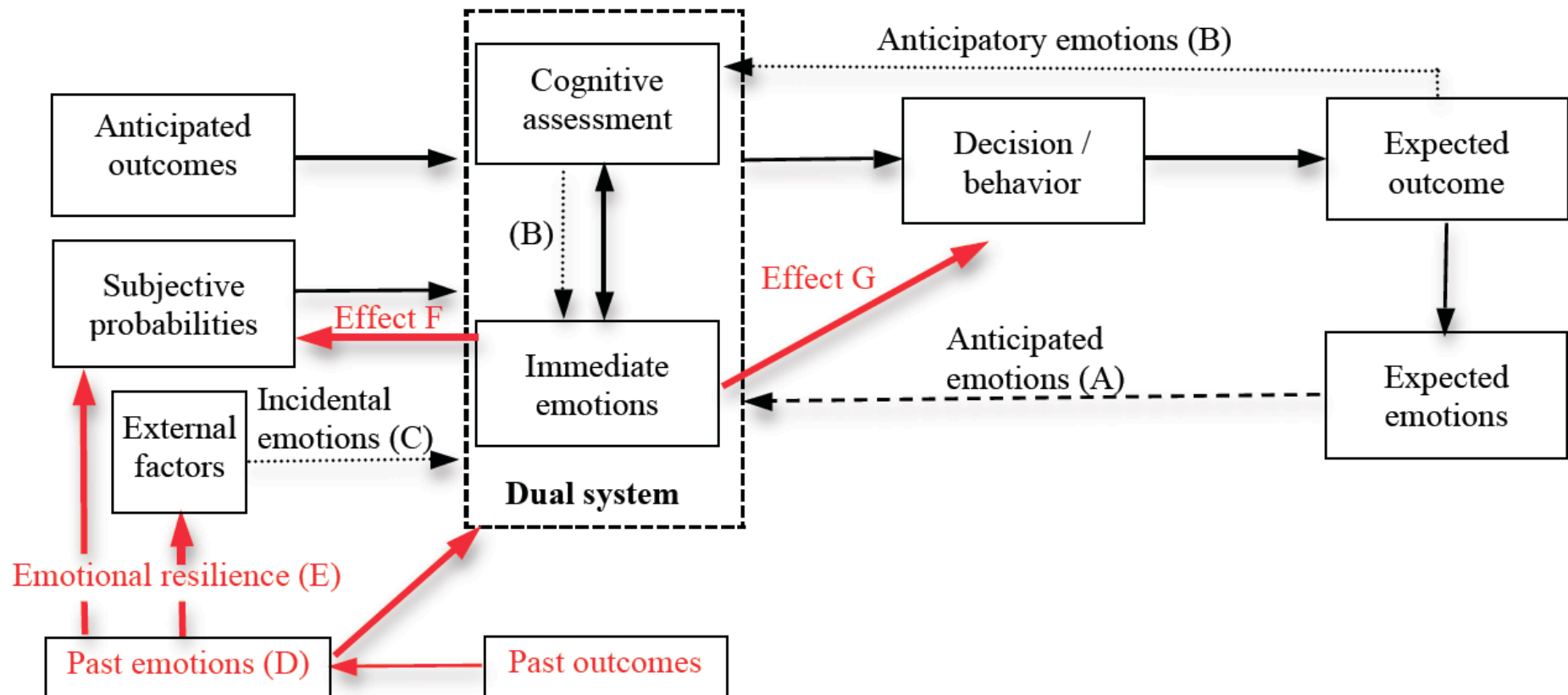
Past emotions (D): Emotions an individual felt in the past, when s/he experienced an event similar to that s/he faces currently, affect her/his current assessment of probabilities and outcomes. The recollection of the event and the emotions felt when it is recalled are a reminder of the emotions felt at the time of the event.

Comprehensive representation of decision under uncertainty with emotions



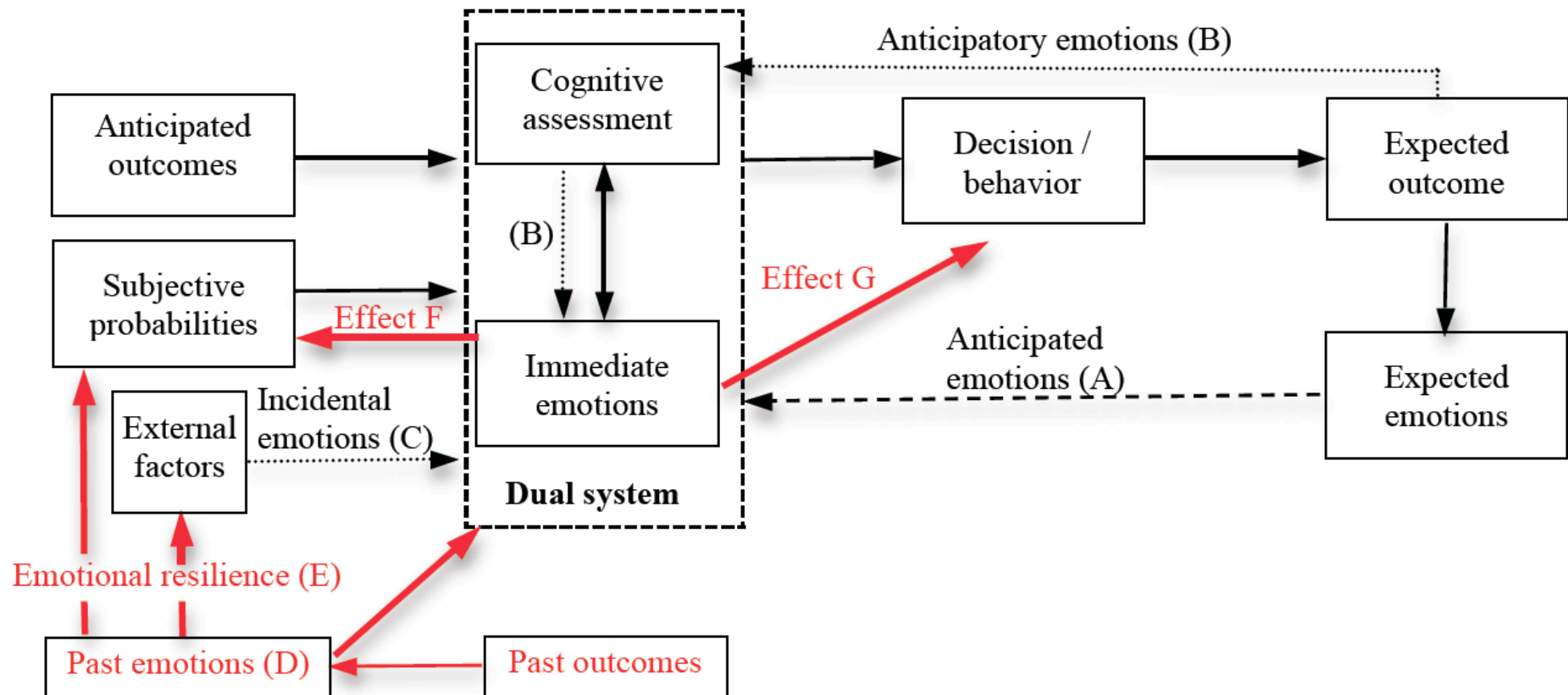
Emotional resilience (E): Emotions felt in the past have an impact on current external factors independent of the decision (personality traits, preferences or the subjective perception of the probability of occurrence of the event).

Comprehensive representation of decision under uncertainty with emotions



Prevention focus reinforcement (F, sub-case of B): Emotions activate a prevention focus attitude, with increased attention being devoted to preventing the occurrence of the negative event. They affect the cognitive assessment of the risk through the subjective beliefs channel.

Comprehensive representation of decision under uncertainty with emotions



Stress response (G): Immediate emotions can contribute directly to the decision through an emotional decision-making process that competes with the cognitive one: they hinder rational decision-making by triggering automatic responses in reaction to some perceived threat.

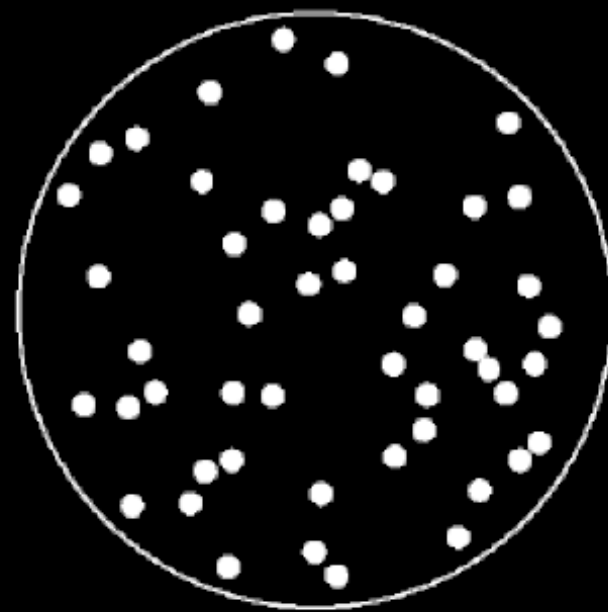
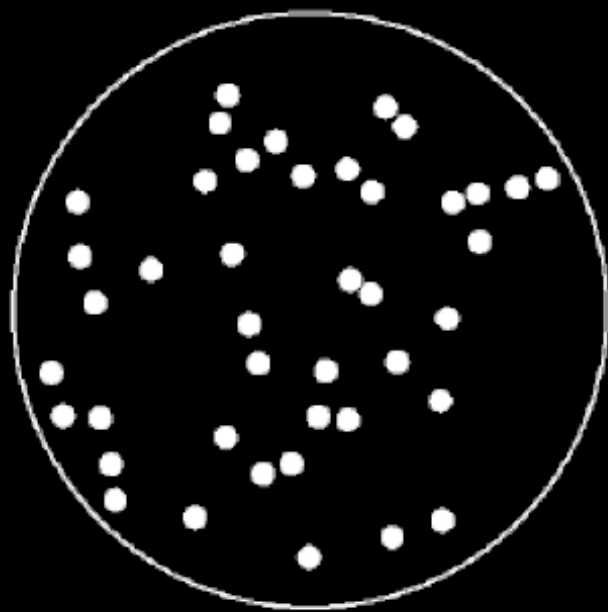
III INVESTIGATION: Artificial and real-life catastrophic events

Artificial catastrophic event (Experiments in May and July 2012)

- Repeated decisions on insuring against the risk of failing in a real effort task (perceptual numerosity task), with the emotions felt being manipulated.
- Catastrophic event when subjects are confronted with a low probability of losing a high gain.
- Why perceptual numerosity task?
 - each trial is very quick (0.7 second),
 - we can control for difficulty,
 - robust psychophysics models and tools (Signal Detection Theory) to treat the data.
- 98 students did 64 repeated decisions (of 5 tasks each) = $98 \times 64 = 6272$ obs.

Perceptual numerosity task:

Find the circle that contains the most dots between two circles. Subjects give their choice (right or left) and their level of confidence from 0 to 100.



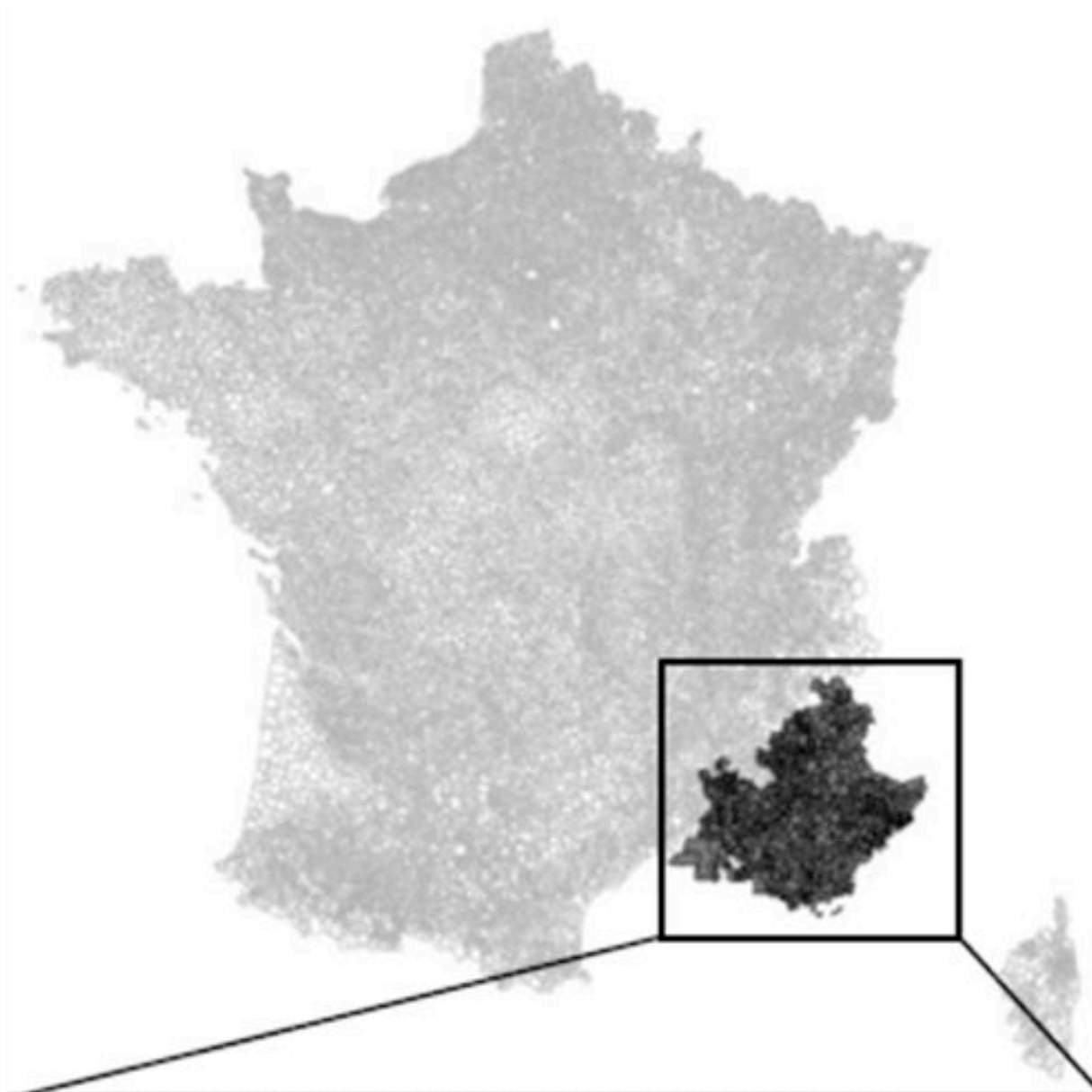
Real-life catastrophic event: Flood (survey from April to June 2012)

Why flood?

- A quarter of the French population is at risk of flooding.
- €4.7 billion paid out between 1995 and 2006 under the natural disaster warrant.

Sample

- 599 respondents interviewed at home face-to-face in four municipalities in the Provence Alpes Côte d'Azur region (South Eastern France).
- Gradient in flood risk exposure: one never flooded and not at risk, one never flooded but at risk, one flooded 20 years before the survey and one two years before the survey.





Data collected to characterize the emotional dimension

In both investigations:

- respondents' sense of control (Rotter, 1966),
- whether overly worried or conscientious (Big Five Inventory, John et al, 1991),
- aversion to risk in everyday life,
- subjective assessment of their level of happiness and luckiness.

In the laboratory experiments:

- mood at the beginning of the experiment (Brief Mood Introspection Scale (BMIS), Mayer et al., 1988),
- score to measure the personality trait “worry” (Penn State Worry Questionnaire, Meyer et al., 1990) each time the subjects face a new decision-making problem.

In the flood field survey:

- Post-Traumatic Stress Disorder (Weathers & Ford, 1996) and origin of PTSD.
- emotions that s/he anticipates feeling in the event of future flooding,
- willingness to participate in actions that will reduce risks and Willingness To Pay for protective devices (↘ the hazard) or individual insurance (↘ the vulnerability),
- subjective assessment of the risk of flooding at the place of residence in the coming year, in the next 10 years and in the next 100 years,
- score for severity of the flood (zero for those who have never experienced flooding).

IV FINDINGS

METHODS

Tests of equality of means (or proportions), Kolgomorov-Smirnov tests, correlation tests, and regression results.

RESULTS

- The prevention focus triggered by negative emotions reinforces the perception of threatening events (Effect F).
- **Emotions have an effect on decisions** but the nature of this effect is complex:
 - Anticipated emotions impact desire to protect, not the importance of this protection (Effect A).
 - Immediate emotion (anxiety) increases WTP for insurance through the cognitive evaluation channel (Effect B/Dual system) (not via the stress channel, Effect G).
 - The loss frame activates a stronger stress response (Immediate emotion) but no effect on the WTP for insurance (Effect G).
 - Counter-intuitive relationship between past emotions and decisions: having experienced flooding before and the severity of flooding are negatively correlated with WTP to protect (Effect D).

RESULTS CONTINUED

- Immediate incidental emotions are associated with external factors that are not related to the decision on the flood event (Effect C).
- Having experienced a flood (even without severe consequences) can affect some personality traits in a durable way (Effect E).

Overall, emotions may help explain choice under uncertainty related to catastrophic risks.

V ONGOING RESEARCH

- The different types of negative emotions need to be better distinguished.
- We need more finely-tuned analyses regarding the effect of emotions on perception of the efficiency of protection, whether via physical devices or by insurance.
- While our lab experiment reveals that insurance is perceived as efficient when people feel anxious, future work should assess whether this holds true in other emotional situations.
- Do emotions felt change risk behaviours? We are currently investigating the stability of time and risk preferences by exploiting pre- and post-deployment surveys conducted for the soldiers deployed to Afghanistan.