A simple experiment on the effects of experienced regret and context

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Modelling Regret in decision under uncertainty

- Typically as "anticipated regret"
  - A function of the difference between the outcome resulting from your choice and the outcome which would have resulted had you made a different choice
  - Giving a modified expected utility
    - Utility from outcome *minus* the experience of regret
    - prediction (utility from outcome) *minus* prediction (experience of regret)
      - Loomes and Sugden (1982) (1987)
      - Bell (1982)
      - Sarver (Econometrica, 2008)
      - Hayashi (JET, 2008)
      - Application to Auction Theory by Filiz-Ozbay and Ozbay (AER,2007)
      - Application to Currency Hedging by Michenaud and Solnik (JIMF, 2008)

Moving to Experienced Regret

- How does the experience of regret impact what you do next?
- Neuroscience approach
  - Camille et al. (2004)
  - Coricelli et al. (2005)
  - Nicolle et al. (2011 x3)
- Behavioural approach in the lab
  - Zeelenberg and Beattie (1997)
  - Creyer and Ross (1999)
  - Raeva et al. (2010) (2011)

Moving to Experienced Regret

- But also from a theoretical perspective
  - Hart and Mas-Colell (2000)
    - *Regret Matching* in games leading to correlated equilibria
  - Coricelli and Rustichini (2010)
    - *Regret and Envy Learning*
  - Zeelenberg and Pieters & Pieters and Zeelenberg (2007 x2)
    - Theory of *Regret Regulation* – versions 1.0 and 1.1

Context of a decision

- What the literature has turned up is that both anticipated regret and experienced regret can be affected by "characteristics" or "context" of the choices
- Action versus Inaction
  - Kahneman and Tversky (1982)
    - "...subjects felt more [experienced] regret when bad outcomes result from action than when they result from inaction"
  - Ritov and Baron (1995)
    - "...in some situations, anticipated regret is greater for acts than omissions" – **Omission Bias** or **Action Effect**
  - Zeelenberg et al. (2002)
    - The effect is reversed when feedback from a previous choice is negative – **Inaction Effect**

Context of a decision

- Status Quo Bias
  - Conceptually similar to the inaction effect, but applied more directly to a problem of repeated decision making
  - Samuelson and Zeckhauser (1988)
    - People prefer to maintain the status quo
    - "Avoidance of decision regret is ... one cause of status quo bias"
  - Inman and Zeelenberg (2002)
    - Reversal of the status quo bias in the presence of prior negative feedback
    - Subjects declare they would feel more regret in such cases
  - Nicolle et al. (2011)
    - Increased activity in left anterior insula when rejecting the status quo
    - Left anterior insula linked to regret (Chua et al. 2009)

Context of a decision

- Responsibility
  - Possible underlying cause of both omission and status quo bias
  - I would feel *more responsible* for causing something to happen (omission bias) or changing the status quo, and hence would feel more responsible should it go wrong
    - Which enhances the experience of regret
  - Nicolle et al. (2011)
    - Manipulate the degree of responsibility in a decision
    - I have one vote
      - Out of 1
      - Out of 3
      - Out of 5
    - "...regret related neuronal activity in the amygdala was enhanced by increased responsibility

Why is context important for regret?

- Regret is an emotion which does not standalone
- It is always tied to a choice which was made, and a choice which was not made
  - Which makes is easy to mathematically characterise
- But the context of a choice can be multidimensional
  - I chose "Option A"
  - I chose the risky option
  - I chose the option on the left side of the computer screen
    - And that's just in a controlled laboratory!
- Is the emotion of regret, both in experience and anticipation, tied to every part of the context or just some?

Why is context important for regret?

- Omission, status quo and responsibility have been identified as types of "context" or "characteristics" of decisions which are tied to regret in some way
- Are there other sorts of context which are linked too?
  - When are models of regret useful and when are they not?
- It is arguably a more important question when studying the effects of experienced regret rather than the effects of anticipated regret.
  - Because context can *change* across periods
  - Hence, we care about when the effects of experienced regret will matter and when they won't
    - What does our mind tie the experience of regret to?

What do we link the experience of regret to?

- A fun example:
- Suppose I go for a drink in the Terrace Bar
  - I see a girl who I think is quite attractive....
  - I smile across to her
  - She smiles back
  - Options
    - A : Play it cool. Make occasional eye contact. Try to make it look like I'm popular and funny by getting other people to laugh at my jokes.
    - B : Be decisive. Go over. Ask her name. Offer to buy her a drink.
  - I decide on option A
  - But, having finally convinced some people to pretend to laugh at my jokes, I turn round to see her leaving with friends. ☹

What do we link the experience of regret to?

- I regret the choice I made
  - Option A
- But Option A represented a lot of things
  - I regret not being assertive
  - I regret trying to be too clever
  - I regret waiting
  - I regret not trusting my gut instinct
- Does the impact of this regret on my future decisions depend on any of these things re-appearing?
- Or does it simply make me "more regret averse" to all potential regrets in the future?

What do we link the experience of regret to?

- So I'm in the bar again a week later
- And I see the girl again!
- Presumably, this is the one context where my past regretful experience will matter the most
- So I decide to "learn from my mistake" and go over to chat to her
- Her name is Jenny
- But it turns out that she was smiling to a person who stood behind me
- And really has no interest in me whatsoever
- ☹

What do we link the experience of regret to?

- So I now have a whole new experience of regret tied to the decision to be decisive and speak to Jenny
- How does this new experience of regret influence my subsequent behaviour?
  - When I'm deciding whether to approach a girl again...
    - In that same bar
    - Who looks a bit like Jenny
    - Who happens to be called Jenny!
    - Who happens to be called Penny!
  - What about a different context?
    - I need to ask my friend Kenny for a favour....
    - I'm thinking of betting on a horse called Jenny's Revenge...

What do we link the experience of regret to?

- A more economic example
- Suppose I have to choose between a LG TV and a Sanyo TV
  - Apparently similar quality, but I trust the reliability of the LG more, and am willing to pay extra for that
- I buy the LG, and it breaks down shortly out of warranty
  - I regret choosing the LG
  - I regret choosing to pay more money for the brand name
- Suppose I then have to buy a new mobile phone
  - I have narrowed my choice to a cheaper LG, and a more expensive Apple iPhone

What do we link the experience of regret to?

- I previously chose the LG product, and regretted doing so
  - Suppose that makes me less likely to choose an LG product again
- But, at the same time, I also spent more money on a supposedly better brand, and regretted doing so
  - Which now acts on the "supposedly better brand" iPhone
- In this example
  - The context from the initial experience of regret appears again
  - But acts in opposite directions on the decision maker
- Does one of these things matter more than another?

What do we link the experience of regret to?

- It's probably an impossible task to create a definitive list of characteristics and context which matters for regret
  - And the subsequent effect of experienced regret
- Can we approach it the other way?
- Are there characteristics of a decision which simply aren't linked to the experience of regret?
  - Does the name "Jenny" matter in the above example?
  - Does the brand name "LG" matter?
    - Given I don't assume that the probability of my phone failing is linked to the probability of my TV failing

Action versus Decision

- Suppose we think of a choice under uncertainty of being composed of an "action" and "decision"
- The **decision** is the relative comparison of economically important information
  - Utility of consequences
  - Probabilities
    - Hence risk
  - Social considerations
  - Status quo
    - It's probably the status quo for a reason
  - Responsibility
    - I'd prefer it if I could defer the tough decision to someone else

Action versus Decision

- Then think of the **action** as the "button I need to push" in order to effect my decision
- It carries no economic information
- It has nothing to do with my preferences
  - What is the "label" associated with my decision?
  - What button on the screen must I click?
    - It happens to be blue
  - What shape box did my cereal come in
- But, I can regret actions as well as decisions
  - I regret trying this new flavour of cereal which I was unsure about
  - I regret buying the cereal in the small blue box

Action versus Decision

- However, if the effect of the experience of regret is context dependent it seems less likely that the "action" will matter when compared to the "decision"
  - The action never really mattered to you in the first place
  - So why should it matter when it comes up again in the future?
- If we're searching for context which is unimportant for regret
  - Hold constant the decision
  - Manipulate the action
- Designed around the LG example given earlier

A simple experiment

- A simple experiment to investigate context and experienced regret
  - Deliberately simple!
  - The more decisions you ask a lab participant to make, the more potential sources of regret
    - Lose control over the effects of regret, and what you think is causing behavioural changes
- A simple 2 stage, 2 options per stage gambling task
  - Stage 1 generates regret
  - Stage 2 manipulates context, and observes behavioural changes
  - Gambles resolved through dice rolls

A simple experiment

- Stage 1
  - Gamble A
    - 30% chance of winning £14 ; 70% chance of winning £0
    - You win £14 if die lands on 7, 8 or 9
  - Gamble B
    - 70% chance of winning £6 ; 30% chance of winning £0
    - You win £6 if the die lands on 0, 1, 2, 3, 4, 5 or 6
- Die rolls resolved by a video of a die being rolled
  - http://go.warwick.ac.uk/slovelady/v1
  - Random video for each session

A simple experiment

- Picking Gamble A and losing results in the experience of "Type A" regret
  - I regret acting in a risky fashion and not choosing a safer option
- Picking Gamble B and losing results in the experience of "Type B" regret
  - I regret acting too conservatively and not choosing a riskier option
- Picking either gamble and winning results in no regret
- The effect of Type A regret may be different to the effect of Type B regret
  - Hence they will face different second stages

A simple experiment

- Stage 2
  - In keeping with the LG example, we need to split the link between the **action** and the **decision**
  - What was previously the relatively risky bet should now be the relatively safe bet
    - Gamble C (very risky)
      - 10% chance of winning £50 ; 90% chance of winning £0
      - You win £50 if the die lands on 0
  - What was previously the relatively safe bet should now be the relatively risky bet
    - Gamble X
      - 100% chance of winning £4
      - You win £4 if the die lands on any number

A simple experiment

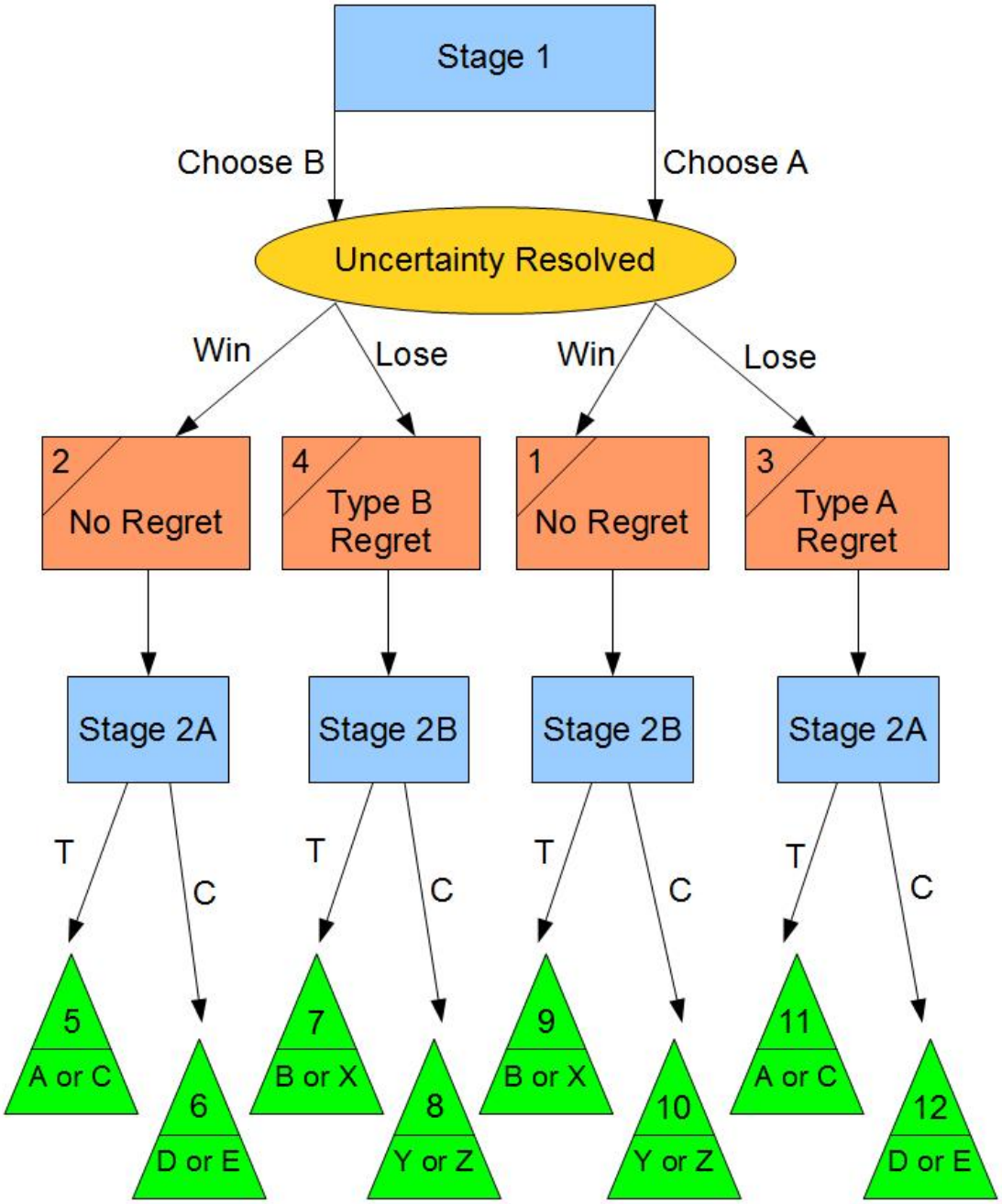
- Stage 2 A
  - You experience Type A regret in stage 1
  - You then choose between the (now) relatively safe Gamble A
  - And Gamble C
- Stage 2 B
  - You experience Type B regret in stage 2
  - You then choose between the (now) relatively risky Gamble B
  - And Gamble X
- We flip the decision around
- But keep the context of the actions
  - Do you want to choose GAMBLE A again?

A simple experiment

- The idea was to control the decision, and manipulate the context of the action
  - To see if experienced regret – linked to actions – has any effect
- So we need some "control" gambles
  - Which form exactly the same decision
  - But break the action context
- Gamble D – (0.3, £14 ; 0.7, £0)
- Gamble Y – (0.7, £6 ; 0.3, £0)
- Gamble E – (0.1, £50 ; 0.9, £0)
- Gamble Z – (1, £4 ; 0, £0)
  - But we roll 2 dice instead of 1 – Numbers between 00 and 99

A simple experiment

- And then randomly allocate people to the treatment or control versions of Stage 2 A and Stage 2 B
  - For logistical reasons, we could only allocate entire sessions to either the control or treatment groups
    - Videos needed to be set in advance of the sessions
- Hypotheses are based on comparisons between behaviour of control and treatment groups, given the presence or absence of Stage 1 regret
  - Not based on comparisons between those who "did" and "did not" experience Stage 1 regret, given the allocation to control/treatment groups


Stage 1
Choose B
Choose A
Uncertainty Resolved
Win
Lose
Win
Lose
2
No Regret
4
Type B Regret
1
No Regret
3
Type A Regret
Stage 2A
Stage 2B
Stage 2B
Stage 2A
T
C
T
C
T
C
T
C
5
A or C
6
D or E
7
B or X
8
Y or Z
9
B or X
10
Y or Z
11
A or C
12
D or E

Experiment hypotheses

- In the absence of regret, simply renaming the gambles & resolving the uncertainty with 2 dice instead of 1 has no effect on choice behaviour
  - The proportion of participants choosing A over C at point 5 = the proportion of participants choosing D over E at point 6
- Given the experience of Type A regret, the reoccurrence of a previously regretted **action** causes a change in choice behaviour when holding the **decision** constant
  - The proportion of participants choosing A over C at point 11 ≠ the proportion of participants choosing D over E at point 12

Experimental controls

- In case the randomisation across control and treatment groups did not perfectly work
  - Risk aversion controls
    - Holt and Laury procedure at the very start
    - Without disclosing the results at any stage
  - Age
  - Sex
  - Maths background
  - Ability to correctly compute an expected value
  - Day of experiment

Stage 1 results

	GAMBLE A	GAMBLE B
Number	15	115
As a % of subjects who suffered no stage one regret	11.54	88.46
As a % of total subjects	6.88	52.75

Table 3: Choices of subjects who won in stage one

	GAMBLE A	GAMBLE B
Number	63	25
As a % of subjects who suffered stage one regret	71.59	28.41
As a % of total subjects	28.90	11.47

Table 4: Choices of subjects who lost in stage one

Results of the randomisation

	EXPERIENCED REGRET AT STAGE ONE			
	SAW STAGE 2A		SAW STAGE 2B	
	Control	Treatment	Control	Treatment
Group # on flow chart	12	11	8	7
# of subjects	31	32	12	13

Table 5: Stage two group numbers given regret experienced at stage one

	NO REGRET AT STAGE ONE			
	SAW STAGE 2A		SAW STAGE 2B	
	Control	Treatment	Control	Treatment
Group # on flow chart	6	5	10	9
# of subjects	61	54	8	7

Table 6: Stage two group numbers given no regret at stage one

Stage 2 results

% OF SUBJECTS CHOOSING SAFE OPTION	CONTROL	TREATMENT
who experienced regret at stage one	29.03	59.38
who experienced no regret at stage one	62.30	70.37

Table 9: Percentage of subjects who chose the relatively safe option at stage two

	DIFFERENCE IN MEAN	
S2 Safe Choice?	-0.303*	(0.015)
Observations	63	

p-values in parentheses

* p < 0.05, ** p < 0.01, *** p < 0.001

	DIFFERENCE IN MEAN	
S2 Safe Choice?	-0.0808	(0.366)
Observations	115	

p-values in parentheses

* p < 0.05, ** p < 0.01, *** p < 0.001

	(1) S2 Safe?	(2) S2 Safe?	(3) S2 Safe?
Treatment? (d)	0.294*	0.372**	0.387**
	(0.037)	(0.010)	(0.007)
Age	-0.0140	-0.0149	-0.0161
	(0.760)	(0.743)	(0.721)
Male (d)	0.0307	0.0624	0.0640
	(0.853)	(0.714)	(0.708)
EV Correct (d)	-0.251	-0.343	-0.339
	(0.181)	(0.078)	(0.083)
Attended session on day 2 (d)	-0.142	-0.146	-0.139
	(0.330)	(0.324)	(0.349)
Year of Study	-0.0673	-0.0591	-0.0622
	(0.485)	(0.550)	(0.529)
A-Level Maths (d)	0.233	0.305	0.278
	(0.270)	(0.129)	(0.192)
Dept which uses maths (d)	-0.0652	-0.0408	0.0141
	(0.814)	(0.885)	(0.961)
Session start time	-0.0552	-0.0474	-0.0523
	(0.156)	(0.241)	(0.206)
HL Safe Choices		0.0707	-0.0521
		(0.082)	(0.778)
HL safe choices squared			0.0116
			(0.497)
Observations	63	63	63
Pseudo R^2	0.139	0.176	0.181

Marginal effects; *p*-values in parentheses

(d) for discrete change of dummy variable from 0 to 1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Stage 2 results

Probit model showing the determinants of choice at stage two for those who experienced Type A regret at stage one.

Shown are the marginal effects of each independent variable, evaluated at the mean.

	(1) S2 Safe?	(2) S2 Safe?	(3) S2 Safe?
Treatment? (d)	0.0828	0.0867	0.0575
	(0.371)	(0.354)	(0.541)
Age	0.0107	0.0275	0.0549
	(0.824)	(0.614)	(0.295)
Male (d)	-0.225*	-0.231*	-0.282**
	(0.016)	(0.013)	(0.003)
EV Correct (d)	0.0393	0.0262	0.0305
	(0.705)	(0.801)	(0.777)
Attended session on day 2 (d)	0.156	0.147	0.174
	(0.096)	(0.117)	(0.068)
Year of Study	0.0744	0.0599	0.0400
	(0.351)	(0.478)	(0.631)
A-Level Maths (d)	-0.185	-0.175	-0.181
	(0.112)	(0.139)	(0.125)
Dept which uses maths (d)	0.00481	0.0132	0.0470
	(0.971)	(0.921)	(0.736)
Session start time	0.00859	0.0130	0.0206
	(0.716)	(0.589)	(0.415)
HL Safe Choices		0.0455	0.516**
		(0.115)	(0.004)
HL Safe Choices Squared			-0.0398**
			(0.007)
Observations	114	114	114
Pseudo R^2	0.130	0.147	0.207

Marginal effects; *p*-values in parentheses

(d) for discrete change of dummy variable from 0 to 1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Stage 2 results

Probit model showing the determinants of choice at stage two for those who did not experience regret, but won choosing Gamble B, at stage one.

Shown are the marginal effects of each independent variable, evaluated at the mean.

Interpretation of results

- The experience of Type A regret had a causal effect on behaviour of the treatment group due to the reoccurrence of a previously repeated **action**
  - Where we defined an action to be something which isn't typically important to the decision maker
- This is a very simple manipulation of the context
- But is sufficient to cause a big change in behaviour in the presence of regret
- It's not possible to say the experience of regret changed subsequent regret aversion
  - As other experiments have tended to say

Alternative interpretations

- Gambler's Fallacy type
  - Gamble A lost in stage 1, therefore it will win in stage 2
  - But this was true for those who chose Gamble B and won in stage 1
    - And it didn't affect their behaviour
  - So the Gambler's Fallacy becomes conditional on choice
- This is just the "status quo bias"
  - Gamble A was the status quo if you chose it in stage 1
  - Changing it to Gamble D is sufficient to break the status quo
  - But the literature on the status quo suggests you are **less** likely to choose it again if you received negative feedback
    - These results say you are **more** likely to choose it again

Conclusions

- The effects of experienced regret on future choice are context and characteristic dependent
- However, it is very simple to create and destroy this context, by manipulating the **action** associated with a decision
- Important contexts discovered so far relate to fundamental questions about the degree of responsibility an individual associates to the outcome of their choice
- However, this experiment demonstrates that the same effects can be achieved through more mundane channels