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# CHAPTER 6: NEGLECT DEFAULTING *

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Chapter 6 (*Neglect Defaulting)*

This chapter is about cognitive illusions in the form of simple logical questions that overwhelmingly prompt answers that are not smart from subjects who are. It has nothing immediately to do with NSNX. But the argument developed here is essential for the analysis of cooperation experiments that will take up the following four chapters. I begin by explaining the diversion.

Half of the 2003 Nobel Prize in economics went to Vernon Smith for his pioneering work in establishing *experimental economics* as a major subfield within economics. The other half went to a psychologist, Daniel Kahneman, for his work (mostly with his late collaborator Amos Tversky and with economists, especially Richard Thaler) in exploring departures from the narrowly rational choice accounts that had for a long time been almost unchallenged among economists and game theorists. That cognitive work has created another major subfield, *behavioral economics*. The two are intimately linked. For exploring or even clearly exposing cognitive anomalies is almost impossible outside the controlled realm of a laboratory. So experimental economics is an essential complement of behavioral economics. But the converse is also true.

The experimental economics work of course has been much concerned with simulations of auctions and markets. But almost from the start it has also been concerned with choices that are intrinsically social: with public as well as private goods. And sometimes the results have been anomalous, in the sense that we see choices, which are hard to make sense of in terms of any plausible model of rational choice. Further, anomalies are especially conspicuous in the context of *social* choices, where players who somehow manage to cooperate do better than players who don't. And it is easy to understand why that might be so. If I am making a choice for myself alone, even a choice that interacts with others (as in an auction), but where I have no doubts about what others are trying to do -- like me, they just want to buy cheap and sell dear, maximizing their profit – then I may still be subject to some cognitive illusion, giving rise to anomalies with labels like "winner's curse", "probability neglect" and many others. But a further and severe layer of difficulty comes with extension of the work to social choices. For then behavior of one person may be contingent on the motivation of others, and what that motivation may be will no longer be unproblematical. If the game is a cooperation

game, I may want to cooperate if I could be confident you want to cooperate also, but definitely not so (I do not want to be a sucker) if you are likely to be choosing selfishly. In particular, on the NSNX conjecture of this study that must be so.

But since laboratory games are not real world situations but simplified and highly artificial analogs of real situations, there is always a question of how far what is seen in the lab reveals insight into actual cooperation and failures of cooperation, as against how far what is revealed is only an artifact of the artificial situation (List & Harrison, 2003). An essential step in dealing with that difficult topic turns on understanding how far and where choices in the artificial and impoverished environment of an experiment reveal some misperception or misunderstanding of the game that is being played, as opposed to choices that reveal how players would choose if they had the kind of understanding of the game that corresponds to their behavior in normal social situations. Even when misperceptions seem to be in play, further steps are needed to identify situations in the world that might give rise to similar misperceptions and judge where (and whether) such circumstances are of much empirical significance. In the final chapters here I will try to say something about such questions. But as background I need an account of cognitive anomalies in social experiments. And as the basis for that I need the account in this chapter of certain cognitive anomalies in the far simpler contexts of individual choice.

From a Darwinian perspective there surely must be default responses available to handle commonly encountered situations when familiar cues are sparse or weak or conflicting. Creatures who survive must come equipped with defaults for what to do when they would otherwise be unsure what to do. A conspicuous example would be the fight-or-flee situation. This is pervasive in nature. Indefinite hesitation is not a viable option. And even an elephant would probably do best if equipped with a *flee* default when in doubt, though presumably an elephant would not often be in doubt.

The defaults must be usually *benign* (or they would not be selected for as defaults), but sometimes these usually benign defaults must turn out to be *adverse*. That should not be in the least controversial. But the particular role of defaults discussed here seems to have gone essentially unnoticed. That in itself is an interesting cognitive point, but perhaps not surprising. The bare existence of what I will call *neglect* defaults could

be expected. But their strength in some contexts is very surprising, and it is perhaps not surprising that it is hard to believe in something so surprising.

What makes sense of cognitive shortcuts in general is that they conserve attention when the delay otherwise required would be too costly to tolerate (as with the default for fight-or-flee situations), or simply useless, or inefficient, or something else easily interpreted as a reasonable response to the circumstances at hand. But what defines the *neglect* defaults is not the economy of using them on particular occasions (which is usually negligible), but that the occasions for the default responses are so very common. Without neglecting almost all such occasions by default, a person would be overwhelmed by hesitations. These are hesitate/*proceed* defaults. As long as the default is in place, we rely on what Gladwell (2004) popularized as our "blink" intuition and proceed, not hesitate. The hesitations avoided are usually individually negligible, but in the aggregate they would be an intolerable burden.

We constantly make choices, mostly trivial, mostly in fact not reaching the level of conscious attention. We also constantly encounter opportunities to hesitate and reconsider whatever choice is on the table at the moment. So if we had to adopt a default rule about whether to stop and reconsider a choice when we have no sufficient indication one way or the other, we would be crippled unless that rule made us unlikely to do that. If I am walking across a minefield, it will not take much to get my attention, but in an ordinary field I will not stop to consider how to maneuver around every bush I encounter. I know it is possible that if I looked more carefully I would see a rusty nail or maybe even a rattlesnake. But I move on, disregarding such possibilities unless some cue is salient enough to displace the *proceed* default. Random choices will be almost always be good enough, while spending time mulling every choice would be a disaster. But inevitably cases will arise in which proceeding rather than hesitating will turn out to be a mistake.

Noticing an *adverse* neglect default at work, however, need not be easy even when a chooser is ignoring information immediately at hand which could surely improve a choice. Suppose that indeed I have an opportunity to improve a choice. There might nevertheless be enough difficulty or complexity to the problem to make it hard or unprofitable to actually use that opportunity. That provides a tempting route to denial

that *neglect* defaulting might have serious consequences. Even if there isn't actually much actual difficulty or complexity to the problem, it might be tempting to suppose there is. For even inferences that we make routinely and easily can sound complicated and difficult if we try to spell out every detail of how to reach the inference. I can assure you that it is no trouble at all for me sneeze. But if someone could write out all the nerve signals and muscle movement required for that, you might wonder how I can possible manage it all. I will make an effort to pre-empt that line of denial of the role of neglect defaults.

*Three neglect defaults*

Three defaults come into the discussion here. Each is some functional equivalent of a hesitate/*proceed* neural switch whose default position is "proceed", so that the effect of the default is to neglect some possible occasion for stopping to think about how an incremental piece of information might be relevant to a choice at hand -– in the context of a puzzle, how to answer the puzzle. Each allows a person to proceed rather than hesitate unless a sufficient jolt pushes the default switch to hesitate.

Escape from the default might operate by cuing escape from a primary hesitate/*proceed* default. Alternatively, the primary default might itself not be a neurally embedded mechanism, but only the union of all the secondaries, which operate independently, or at least on the same level. How the neurophysiology works is not needed for the argument here.

(1) *Incremental information*. Suppose that I stop to consider a piece of incremental information which has come to my attention while considering a choice. I might then judge the effect of that information as significant enough to warrant taking more time to think about it. Call that the *interactive* case. There seems likely to be some consequential interaction between the novel item and the choice I face. But perhaps what I do, or might do, does not look like it interacts significantly with that incremental information. In that case, I would have done better to have just neglected the issue and proceeded. Of course I cannot know how I would judge that interaction possibility unless I hesitate long enough to consider it. But if I stopped to consider whether a choice is *interactive* or *passive* with respect to anything that came to attention while facing a

choice, I could hardly get through the day. We are facing choices all day long. And whenever we consider a choice we will be aware of other things in the vicinity of the choice that conceivably might be affected by the choice, or which perhaps ought to influence the choice. If I go on the picnic, that does not make it more likely to rain (a passive case). I would not gain anything by stopping to think about the difference in the probability it will rain, contingent on the picnic. But if I bet the limit in a poker game that does make it more likely other players will fold (an interactive case), and I better think about who might fold and how likely that would be If another player seems to be studying how many chips I have on the table, that might well be relevant to what I should do and I ought to consider that. So there are many contexts in which I would do better to hesitate. But to get through the day I will have to just proceed unless the context somehow jolts me to sufficiently to stop and consider this or that thing that comes to my attention. As between interactive or passive, *passive* will have to be the default. So this is a quite transparent application of the notion of a default favoring *proceed* over *hesitation*.

The interactive/*passive* default is about how readily an agent can be prompted to look ahead or look around and think about the effects of some item at least momentarily in sight. An example of that would be when inferences from recent or local experience might be improved by adjusting in light of some item of long-term or global experience. And the particular context of that sort that has gotten special attention concerns statistical base-rates. For attention to or neglect of base-rates, being quantitative, lend themselves to formal discussion (Bayes' theorem) and tightly designed experiments. But merely quantitative cues which logically should but cognitively do not prompt affective or causal or otherwise sensitive alerts would be especially vulnerable to adverse neglect.

In an extensive review, Koehler's (1996) showed that even naïve choosers sometimes act as proper Bayesians, adequately taking into account base rates. But at other times even sophisticated choosers are likely to ignore base rates entirely and might do so even in a context where it is hard to make rational sense of that. And indeed it often does make sense to ignore base rates, or give them only modest weight, because the conditions that make their full use logically compelling are often lacking in real-world contexts, as Koehler stressed. But even when that is not so, absent cognitively effective

cues, the default would be to tacitly neglect possible correlations between the local context and whatever is in the global background. So *if* (I am not claiming to have shown it yet) neglect defaults might be much harder to dislodge than we would consciously see as sensible, then base rates might often be ignored by default, even when logically it is clear that they shouldn't be.

And the point relevant to this entire topic of defaults is that what is needed to cue departure from neglect of base rates is apparently something more than verbal guidance in a problem statement that logically entails giving attention to what might be neglected. Merely specifying a base rate often has close to zero effect./1 But a clue to what might govern stubborn neglect is the very large difference it can make whether a logically relevant base rate is stated as a fraction (.34) or as a frequency (34 out of 100) even when the subject is someone who knows very well that what .34 means is that he can expect 34 out of 100 cases to go that way. What appears to be a logically inconsequential gap (between .34 and 34/100) often turns out to make a cognitively large difference. Sometimes it seems it seems to take a very direct jolt indeed to nudge the switch from proceed to hesitate.

(2) *Modus tollens neglect.* As with "base rate" neglect, "modus tollens" is academic talk for something routinely encountered without any such label. When one thing entails another, if that second thing is absent the first thing ought to be also absent. You need no formal study of logic to know that "if it's raining it will be cloudy" lets a person suppose (modus tollens) that if there are no clouds it is not about to rain. But opportunities to notice totally useless modus tollens inferences are ubiquitous. Overwhelmingly, we just ignore those opportunities. Using an example much discussed among philosophers (Hempel's paradox), suppose I assure you that "all ravens are black". And I am wearing a green tie. Noticing something green, and observing that it is my tie, should you not gain an extra mite of confidence that indeed all ravens are black? For no one doubts that "all ravens are black" implies (you will follow even if you have never studied formal logic) that "non-black things are non-ravens". And my green tie indeed is not a raven, just as predicted by a theory that all ravens are black. So here is a bit of evidence supporting that theory. Philosophers debate how to handle this silly but logically impeccable inference.

But unless provoked by an academic discussion we do not notice this silly inference at all. Rather we are protected from wasting time noticing it only to have to waste more time concluding it was not worth noticing. It takes a raven to provide us with an occasion where we might check for a case where a raven is not black. But it only takes an object which is not black to provide an occasion when we might check for a case where (modus tollens) a non-black thing is a raven. We could spend the day gathering such evidence at a prodigious rate and be no more confident than we were at the start that indeed all ravens are black.

Nor is the burden of inferring what might be implied modus tollens limited to the very occasional cases of sweeping generalizations like “all ravens are black”. Mom says, "Dinner will be ready by the time you get hungry." So the kid expects that if dinner is ready, he will be getting hungry. But he is not burdened every few seconds over the next several hours with thoughts of "I'm not getting hungry, so dinner isn't ready."

So in addition to the looking ahead (interactive/*passive*) or looking-around (what we could label global/*local*) categories of the general hesitate/*proceed* pairs, we can identify at least one logical category (modus tollens) that ought to be subject to mostly benign but potentially adverse defaulting.

As with base rates, it is not that people untrained in formal logic are incapable of noticing and using everyday versions of modus tollens (I will give some further examples in a moment). Rather a tacit default blocks such inferences unless there are sufficient cognitively effective cues in the context to displace that default. And we can observe, and not just in artificial puzzles, that bare logic does not easily offset beliefs supported by interests, emotions, physical experience, or social pressures, so that perhaps we should not be surprised to find that bare logic unsupported by interests, emotions, physical experience, or social pressures also does not easily offset defaults likely to have been entrenched long before our ancestors had any capacity for explicit logic, and presumably to some substantial extent before our ancestors had language to reason with. .

3. *Ordinary language.* And the most readily understood of this set concerns how we pragmatically respond to language. An entire academic movement (deconstruction) was built around the inevitability of multiple meanings for anything we might say or anything an author might write. Language is intrinsically *polysemous*. The

hesitate/*proceed* default is to rely on what Gladwell has popularized as “blink” intuitions. We do not think about what is intended. Ordinarily, we take it to be immediately transparent, though if you try to parse it out in an exact way it often proves difficult to say why it should be seen as transparent. This is so utterly commonplace that no detailed argument is likely to be needed to persuade a reader that our understanding of language relies heavily on a default that it takes a jolt to displace. The pragmatics that tacitly guide our understanding of language have been quite elegantly discussed in Grice’s set of William James lectures at Harvard in 1967. Deconstructionists, logicians, and lawyers in one way or another develop very refined techniques for picking apart the multiplicity of meanings of ordinary language. But outside of very specialized contexts, even deconstructionists, logicians, and lawyers use and comprehend language in the pragmatic, taking-it-for-granted, tacit way that everyone else does. Outside of specialized professional contexts they *hesitate* to mull the multiplicity of possible meaning in every remark no more than you do. Overwhelmingly, they just *proceed*. .

*1. Wason*

Each of the three examples of hesitate/*proceed* defaults now in place (interactive/*passive*, modus tollens neglect, ordinary language) will next be illustrated with the help of some striking cognitive illusion, starting with the Wason selection task, which is by some wide measure the most exhaustively studied of all cognitive illusions:

> *Four cards are labeled "A" or "D" on one side and "2" or "3" on the other. A rule says: "If the letter is A the number must be 2."*
>
> *You see two of the cards letter side up, the other two number side up.*
>
> *Which need to be turned over to find any violation of the rule?*

A majority of people, offered the array [A,D,2,3], respond by choosing "A&2" or only "A". Few give the correct response of “A&3”. Understanding *ex post* that turning the "2" is beside the point (a D on the other side of 2 *would not* violate the rule) is easy, and so is understanding that you must turn the "3" (an A on the other side of 3 *would* violate the rule). But usually upward of 90% of subjects miss that logically almost trivial inference. Professors do not do much better than their students. The “if/then” rule can be

pragmatically read either as a conditional (as in "if it's raining, it is cloudy") or biconditional (as in "if it's nice we'll go on a picnic"). Context that ordinarily would suggest an intended meaning is absent in this abstract puzzle. That the most common response is “A & 2” not "A" shows that the reading is more likely to be biconditional though as a sentence in formal logic it would not be read that way. The deeper question is why smart people are so likely to get this simple problem wrong even if the verbal ambiguity is explicitly resolved.

The usual explanations turn in one way or another on a claimed limited capacity of human beings to handle the "modus tollens" inference: “if p then q, & not-q, therefore not-p.”. For some (eg., Cosimedes 1989) the intrinsic difficulty of modus tollens outside of special contexts is the heart of the matter. For others, the difficulty of modus tollens is a component interacting with other difficulties. So Sperber et al (1995, p. 52), tying the argument to Sperber & Wilson (1986), argue that “the artificiality of the task is so overwhelming as to discourage any but the lowest expectations of relevance, and anything except the most superficial interpretation processes.”/2

On a “modus tollens is difficult” account, outside of specialized contexts (cases of moral or legal obligation, for example), it is burdensome to try to use modus tollens, so that subjects either usually can’t do it, or at least are discouraged from making the effort. But do people really have any difficulty noticing that "if he's coming, you'll have a message on your phone" implies that "if the message light is not blinking, apparently he isn't coming". More generally, how could incompetence handling "modus tollens" be plausible in evolutionary terms, since although we couldn't get through a day if we noticed every available modus tollens inference, we also couldn't get through the day effectively without informally responding to many such inferences.

We use modus tollens so readily we do not ordinary notice when we do it. And it would be a puzzle if our brain has not evolved in a way that ordinarily made that easy.

In terms of the *neglect* defaulting proposed here, the Wason illusion does not turn on modus tollens being difficult to handle, so choosers miss it, but on the ubiquity of occasions where modus tollens is at hand but pragmatically pointless, so we mostly ignore it.

When I first had occasion to write on Wason (Margolis 1987) I encountered an ad for an anti-dandruff shampoo using the slogan: "If you use it, no one will know. They'll only know if you don't use it." The admen choosing this did not expect that 90% of the audience would have to consult a logician to make sense of the slogan. But to see the point, a person has to see the connection (modus tollens) between the first sentence and the second sentence. A person also needs the pragmatic inference that the reason they know is that they will see dandruff on your clothes. But if the shampoo works there would not be any dandruff to see. So if you do use it, then (modus tollens again) indeed people won't know you use it. Hence parsing out this advertising slogan is by a considerable measure logically more complex than the bare modus tollens inference required for the Wason problem. But people get the point immediately.

In general people can do what you almost certainly did several times in the previous few sentences. We see the point of a modus tollens inference in a subjectively immediate way, with no sense of effort. That fluent competence is in our brains. But the point of the account here is that access to conscious attention is by default turned off in the absence of cognitively effective cues to a context where it is likely to be useful rather than a diversion. The default is that modus tollens is neglected. The switch is off. And on that view, the key to understanding Wason is to notice that the basic Wason puzzle, lacking anything to arouse an affective response or any tie to experience in the world, apparently provides only a very weak bump – a surprisingly weak bump, but we will see the same thing with later examples -- of that modus tollens switch even when as simple logic the occasion is clear./2

Successful remedial versions of Wason most often use language that invokes a sense of obligation or a concern about being cheated, or that invokes a familiar situation in which explicit use of modus tollens is common. There is no puzzle about how these versions provide sufficient affect or recognition to displace a modus tollens neglect default. In an exhaustive analysis, Sperber et al (1995) show that more general conditions are sufficient. It is enough to provoke surprise or curiosity. The simplest maneuver yielding a big improvement (Evans, 1989) is just to change the rule to a negative (here, from "A → 2" to "A → not-3"), which not only makes the *not* card salient, but invokes an element of experimenter demand ("if I'm not expected to suspect

this card, why is the rule framed in this roundabout way?"). Nudged to consider the card, the modus tollens connection is far more easily available.

In my 1987 book, I showed another very simple manipulation, about equally effective, which is to reduce the array of choices from [A, D, 2, 3] to just [2, 3]. The two easy cards ("A", which is rarely missed, and "D", which is rarely chosen) are removed, leaving only the two hard cards: "2" and "3", which supply nearly all the errors. One might suppose, since essentially all errors are in relation to the hard cards, that subjects will continue to do badly. But they don't. Subjects shown an array reduced to [2, 3] will return a majority of correct responses. The defaulting account offers an explanation. Unless modus tollens is switched on, *no* card violates (since "A" is no longer available). But a puzzle normally has a positive correct answer, so that as Evans' negative framing of the rule draws attention to the "3", seeing no card to turn prompts a "look closer" response and a person notices the modus tollens violation after all./3

Another curious effect reported in *Patterns* (with a replication in Griggs, 1989) first frames the question as: "Circle two cards to turn over to check whether the rule has been violated". This unsurprisingly maximizes "A & 2" responses. But when the instruction is turned around to read: "Figure out which two cards could violate the rule, and circle them", the predominant response switches to the otherwise almost never seen "D & 3". The categories/instances conjecture of my account in *Patterns* yields what still seems to me an elegant account of that. But it becomes redundant in the light of the broader neglect defaulting account here. What seems to be happening is this. With only the four combinations the problem statement allows, logically it must be the case that "if A then 2" is true so is "if 3 then D". But modus tollens neglect would make a person miss that. Rather, a set of implications that are often pragmatically appropriate would come into play for "two cards that could violate". Pragmatically "if A then 2" might be intended to also carry "& if D then 3", or "& if 2 then A" or "& if 3 then D" or any combination among these. I provided a survey of the possibilities in *Patterns* (pp. ----). . So if modus tollens is *not* neglected, the salient response would be the same "A & 3" that is correct without specifying "two cards". But if modus tollens is neglected, and with looking for "could violate" candidates more salient in the instruction than "circling two", a person might sense a lot of possibilities. Then Kahneman & Frederick's "attribute

substitution" could prompt subjects to slip from the complex task of choosing among the various "could violate" possibilities, over to the simpler task of picking the two cards that "can't obey" the rule.

This gives an account of a very puzzling result, but not one unique to the "modus tollens neglect" account here, since it would work as well with the usual "modus tollens is difficult". A final variation, however, clearly discriminates between the two. A striking illustration but one that requires more qualification uses a slight variation of the rule which logically should make the problem easier:

*RULE: If the letter is D, the number can be either 2 or 3.*
*But if the letter is A, then the number must be 2.*
*Here are the cards, showing the top then the bottom of each card.*

But now *both* sides are shown. Subjects do not need to infer anything. The array is:

A/3 D/2 2/A 3/A

And the task is merely to identify any cards that violate the rule.

There is now nothing in the task that requires use of modus tollens. The A/3, 2/A, and 3/A cards each has an "A" on the letter side. And of them 2/A conforms to the rule but A/3 and 3/A violate it. A person can hardly get this version of Wason *wrong* unless she tacitly sees the A/3 card as "looking like" modus ponens ("if p then q") while the same left-to-right habit of reading prompts the 3/A card to be seen as the modus tollens cognate of the rule. Which (by default), a person would easily neglect. So contrary to supposing that choosers miss modus tollens because of its difficult, here a person has to fluently recognize modus tollens to get the problem *wrong*. We will see another "in your face" case of neglect shortly.

Given the stark triviality of this both-sides version of Wason, it is not a devastating criticism that if the circumstances are such that subjects are motivated to take care, they will probably get this version right. But an *abstract* modus tollens inference, where nothing is there to tacitly nudge the defaulting switch, feels harder than a modus ponens inference. The situation is analogous to what happens if you want to switch a tv channel but have forgotten that the tv/vcr toggle is on "vcr". You need an extra step. The step is trivial, as is the actual channel switch that follows. But there is a perceptible bit of

delay. Here it is easy to notice that facing this both-sides Wason, respondents visibly have some difficulty with the 3/A card and sometimes miss it.

*2. Three cards*/4

But if a *neglect* reading of Wason is sound, then we should be able to find parallels in other cognitive illusions. Here is a favorite brain-teaser from books on probability (Bertrand's box puzzle).

> *Three cards are in a box. One is white on each side, and another is red on each side. The third card is white on one side and red on the other. So there is one white/white card, one red/red card, and one white/red card. Without looking, you take out one card, and lay it on the table.*
>
> *1. Suppose the up-side turns out to be white? What is the chance that the down-side will also be white?*
>
> *2. What if the up-side is red? What is the chance that the down-side will also be red?*
>
> *3. Before you see the card, what is the chance that it has the same color on both sides?*
>
> *4. Suppose you answered 1/2 in response to Questions 1 & 2. That would mean that whichever the up color of the card, the chance is 50/50 that you have picked a same-color card. But if at Question 3 you said that chance is 2/3, aren't you contradicting yourself?*

As implied by Q4, the usual response to (1) and (2) is 1/2 and the almost universal response to Q3 is 2/3. The response to Q4 from the large majority who report 1/2 for Q1 and Q2 but 2/3 for Q3 is then invariably that there must be some mistake in the reasoning which claims to show a contradiction. Indeed this is often a most emphatic response, which is hard to overcome, and especially so for people (like economists and engineers) whose experience in the world gives them confidence that they could not have *mistaken* clear intuitions about such simple probability questions. Yet no *reasoning* is required to see the "1/2" intuition for Q1 and Q2 can't possibly be correct if the "2/3" intuition for Q3 is right. If you can read English, how could you doubt that for a moment? What else could it mean to say that the chances are 2 in 3 that a card has the same color on both sides other than the chances are 2 in 3 that if it is red on top it is red on the bottom, and

ditto for white? But it ordinarily takes a while to get free of the illusory conviction that the chance in Q1 and Q2 is 1/2, and there is a stubbornness of the faulty intuition here very much more severe than can be seen in any of the Wason variants. .

For this 3-card*s* puzzle, another simple argument notices that:

*Ex ante, any of the sides are equally-likely to turn up. If the side you see is red, you know it is one of three equally-likely red sides. Two are on the red/red card, and only one on the white/red card. So the chance is 2/3 that the red side you are looking at is on the red/red card.*

And yet another argument comes from noticing that:

*Ex ante the red/red and red/white cards are equally likely. But when it's red/red the color on top is always red, while when it's red/white, the color on top is red only half the time. So when you've picked on a card with a red side showing, it is twice as often on the red/red card.*

But the immediate, and often far more extended than immediate, intuition of even sophisticated subjects commonly defies the simple logic. The red/red and red/white continue to seem equally-likely no matter which color is showing, as if seeing the color on top tells you nothing. But exactly what the interactive/*passive* default describes is this kind of situation. Anyone starts with a sense that each of the three cards is equally-likely to be drawn. But a further bit of information is provided, but neglected. The color on top is red. This trivially eliminates the white/white card, and on any of the three simple bits of reasoning already given makes the chance 2/3 that the red/red card has been drawn. But few people see that. And parallel to the both-sides variant that concluded the Wason discussion, a strong piece of evidence that indeed this is another case of adverse neglect defaulting is that even an in-your-face inference requiring no argument at all is sometimes missed.

A variant reported by Fox & Levav (2004) tried to help choosers by using the default propensity to treat a set of alternatives as equally likely. Asked for the chance that Sunday would be the warmest day of an arbitrary week, subjects reliably responded "1/7" only if attention was specifically cued to the days in a week. But Fox (& Rottenstreich, 2001) showed that without explicit cuing to "days", subjects seem to anchor on "Sunday" or "not Sunday", as if each was equally likely, with an adjustment well short of what every subject knows is the correct number of days in a week.

Fox & Levan sought to meliorate the downright terrible performance of their Duke students on the 3-card*s* puzzle by pushing them to focus on the colored sides (red/red,

white/white, and red/white) not on the cards themselves. That seems promising, since if a person is focused on the sides, which by a (here benign) default would be correctly seen as equally-likely, then (as in the second bit of reasoning just given) no calculation is needed to see that when the side you see is red, two of the three equally-likely red sides are on the red/red card, only one on the red/white card. But having been initially set to think about the card picked, apparently subjects often answered in terms of the chance they picked the red/red card even though pushed to think about the sides.

For the basic problem, the Fox & Levav results were: 1/2 (59%), 1/3 (13%), 2/3 (2.6%), and others (26%). So barely more than 1 in 40 Duke students (2.6%) got the problem right, leaving a great deal of room for improvement./5

The remedial variant told subjects the sides were labeled red1–red2, white1-white2, and red3-white3. The question was no longer about the card picked but about the sides: "Given that the side showing is red, what is the probability that it is side red1 or red2?" So the manipulation explicitly numbers the sides, and asks specifically about the numbered sides. If the focus stays where the manipulation tries to push it, on the sides, the natural inclination demonstrated by the *days in the week* experiment is to treat the three sides you might see (red1, red2 or red3) as equally-likely. Asked for the chance that the side on view is 1 or 2, would any sensible subject fail to see that the chance is 2 out of 3?

And this quite emphatic manipulation indeed changed responses. In fact, it increased correct responses 10-fold. But the news was not overall very good. The 10-fold increase still only moves the fraction of correct responses from 2.6% to 27%. Almost 3 of 4 (73%) were still getting the problem wrong, even though the question is now about sides of the cards and requires only seeing that the chance of picking "1" or "2" out of the set [1,2,3] is 2/3. Even worse, the modal response changed in a perverse way, revealing a tendency for subjects to revert to thinking about the setup of the problem (a card has been picked) and to then often see the "red1 or red2" question in terms of whether they picked the red/red card. And then they very often get that totally wrong. The illusory but usually modal "1/2" declined from 59% to 24%. But a large share of that decline shifted to "1/3", which now increased its share from 13% to 35%./6 So for some subjects changing the problem to focus attention on particular, numbered sides (red1, white1, etc.) corrected an illusion, but for about as many others it made things worse.

A person who responded "1/2" as least had noticed that one of the three cards was eliminated absolutely (the white1/white2 card). The new modal response (1/3) did not even get that far. Like the both-sides variant of Wason, looking at information that with no non-trivial reasoning at all shows that the card cannot be white1/white1, the modal choice does not notice that the only two cards in play are red1/red1 and red1/white1. The largest fraction neglect the signal entirely, and see the chance that the card is red/red as only 1/3.. Of those who don't, most neglect to look carefully enough to notice the correct response (2/3), though with the strong manipulation focusing on sides not cards, that appears to require no reasoning more difficult than counting to three. So it appears that neglect defaulting can vary in strength. A person might completely neglect what he sees (here yielding the 1/3 response), but he also might hesitate long enough to notice a gross implication (here that there is 0 probability he picked the white1/white1 card), but not long enough to notice the modestly subtler implication needed to reach the logical result. Either way it is hard to see how students at an elite university could do this badly unless somehow they were simply blind to the signal they were given. But that is what the neglect defaulting argument says could happen. And if we now turn to another intensively discussed puzzle, we find a very similar story.

3. Monty Hall

As I write (early 2007) Google reports 275,000 hits for "Monty Hall", overwhelmingly for the puzzle, not for the once TV quizmaster who used a version on his show. But the puzzle in other versions had been notorious among statisticians long before the TV-show version./7 Here is a variant which avoids some ambiguity in the version tied to the TV quiz.

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> *[MH] An Ace and two 5's from a deck of playing cards lay face-down. You must point to one.* ***I then will check the two remaining cards and turn one over to reveal a 5.*** *You win $10 if you end up with the Ace. You can keep your original card, or switch it for the remaining unchosen card. Is there an advantage to switching?*

The usual response is a very confident intuition that there is no advantage to switching. But in fact switching doubles the chance to win. A reader not already familiar with the problem is likely to find this claim incredible. And as anyone who has tried the puzzle on colleagues will know, it can be hard to persuade even extremely sophisticated

victims of this illusion that the immediately and powerfully intuitive response is wrong. Yet the only reasoning required is:

> *[MH*] Since it is 100% certain that at least one of the unchosen cards is a 5, checking them to reveal a 5 doesn't change the 2/3 chance that one of them is the Ace. It just tells which of those cards must be the Ace if either is. So unless you picked the Ace initially (a 1/3 chance), switching wins.*

This reasoning is short, simple, and correct. But until a person is thoroughly familiar with Monty Hall, it is likely to seem like a trick proof that 2 = 3. Even if you can't see what is wrong with it, your intuition can assure you it must be wrong.

Parallel to the card*s* problem, a reader starts from the intuition that any of the three cards is equally-like to be the winning Ace. Once only two cards are left in play that equally-likely intuition yields an illusion unless you adjust that initial sense of the situation for the new information that someone who knows the winning card has been required to reveal a losing not-chosen card. But if the interactive/*passive* default is hard to escape in this arbitrary context, you don't make any such adjustment. You see your initial pick and the remaining unchosen card as still equally-likely to be the Ace.

But if that neglect defaulting is what yields the illusion, then this variant on Monty Hall, which differs only in the italicized sentence, should be easy to get right:

> *[XMH] An Ace and two 5's from a deck of playing cards lay face-down. You must point to one.* ***Without looking, you must turn over one of the two remaining cards. Suppose the card you turn reveals a 5.*** *You win $10 if you end up with the Ace. You can keep your original card, or switch it for the remaining unchosen card. Is there an advantage to switching?*

And the reasoning for this problem would be:

> *[XMH*] When you pick a card to turn (without looking), but before you've turned it, the chances are certainly equal that any one of the three cards is the Ace. And so the chance is 2/3 that one of the other two cards (your first pick and the one you did not choose to turn) is the Ace. Once you turn over the card (blindly, not looking) that changes. If the turned card is the Ace, the other two cards each now has 0 probability of winning. If it is a 5 each now has a .5 chance. Either way, there is nothing to be gained by switching.*

The reasoning is about as simple as the MH* reasoning for Monty Hall, and certainly not simpler. Nevertheless subjects indeed find it as easy to get XMH right as it

is hard to get MH right. That XMH is as easy for subjects as MH is hard is not at all a small point, since analyses of Monty Hall typically explain the trouble subjects have as growing out of its intrinsic difficult, and explain the problem for readers with reasoning far more complicated than the simple but entirely adequate remarks in MH* This parallels the propensity to explain Wason in terms of the difficulty of modus tollens, or to explain the three card*s* puzzle in terms of a Bayesian argument a good deal less simple than any of the three short arguments given here. That probability intuitions are sometimes faulty, even for experts, must contribute to the notorious stubbornness of Monty Hall intuitions. It is trivial to point out the contradiction in ignoring the *not-2* card in Wason, since once attention is explicitly drawn to it, anyone can see that a card with A on the letter side but 3 on the number side violates the rule. But looking at a single play of Monty Hall (or parallel to that, of the three-card*s* puzzle), there is no *error* to be seen. Not switching in Monty Hall might in fact be the winning choice. The trickiness of probability intuitions is itself tied to inability to directly *see* an error in intuition in any single case.

But that does not account for why MH should generate overwhelmingly wrong responses, while XMH generates overwhelmingly correct responses. On the defaulting account, however, there is a very simple explanation. The interactive/*passive* default which is adverse for MH, leaving in place the intuition that the remaining cards are equally likely, is benign in XMH, since now the remaining cards indeed are equally-likely. The default efficiently prompts a person to the correct intuition in XMH, even though the explicit reasoning might be judged a bit more complicated in XMH than in MH. But since the default-governed response happens to be correct, there is no cognitive illusion to be seen. Nor does the problem feel subjectively difficult. Here the default is benign, not adverse. XMH "feels" easy, since to get it right you just ride along with your intuition. But MH "feels" hard. To see why it pays to switch you have to jolt the neglect default switch.

We can notice the same two elements which jointly make the three-cards problem notoriously hard. By default we favor treating the alternatives in sight as equally-likely. And by default we tend to neglect incremental information that might interact with our immediate intuition. So the equally-likely default plays a role here, but so does the

interactive/*passive* neglect default. Relaxing even one of the defaults may be enough to make the puzzle much more manageable. And indeed this variant usually works.

> *[MHdeck] A deck of cards is spread out face-down. You must point to one.* ***I then will then turn over 50 of the remaining 51 cards, but checking first to be sure I don't turn over the Ace of spades.*** *You win $10 if you end up with that Ace. You can keep your original card, or switch it for the remaining unchosen card. Is there an advantage to switching?*

The reasoning for MHdeck is the same that people typically have severe difficulty grasping for MH, but just a bit more complicated since 50 cards are turned not just one. So why would MHdeck be much easier than MH? But picking one card out of 50 is stark enough to jolt a person away from the equally-likely default. In that many-cards context, far beyond what can be managed with iconic perception, the salient intuition is not that card you picked is as likely as any other card (though you would have no doubt of that if asked) but that your pick is not at all likely to be the winning Ace. And now, as with MHX, the neglect default is benign. As before there is actually no connection between the chance you already have the Ace and the signal. But now the intuition that is left in place happens to prompt you to the right choice. For the intuition in place is now that it is unlikely you have the Ace, hence you'd better switch.

Alternatively, try: [MHdeck]:

> *A deck of cards is spread out face-down. You must point to one.* ***You then turn over (not looking) 50 of the remaining 51 cards, and you never turn over the Ace of spades.*** *So the Ace is either your pick or the remaining unturned card. You win $10 if you end up with that Ace. You can keep your original card, or switch it for the remaining unchosen card. Is there an advantage to switching?*

People now are often sure they should switch, though in fact in this case there is no advantage in switching. Think of exactly the same situation framed another way. You pick one card with your left hand. This is "your pick", You now pick another card as the "remaining unchosen card" with your right hand, and then turn over the other 50 cards. If you do this enough times, eventually none of the up-cards will be the Ace. Then either your left-hand or right-hand pick is the Ace. But why would you think your right-hand pick is any more likely to be the Ace than your left-hand pick?

But in the basic version (MH) why not start from the also logically immediate intuition that your pick has 1/3 chance of being the Ace? On the argument here, the neglect default should benignly leave that in place instead of adversely leaving the equally-likely intuition in place. But the history of probability answers that. The equally-likely intuition is primordial. That is why it is a well-marked default. No one discovered "equally-likely" as a default for a context in which you have no basis for supposing one possibility more likely than any other, since everyone always felt they knew it. But the notion of probability as a number (here 1/3) emerged only c 1660 in the wake of the Scientific Revolution that began half a century earlier. I give a detailed discussion in my 2002 book. C, consequently although no one would doubt either intuition (it is equally likely that any of the cards is the Ace/ of three cards, the chance is 1/3 you picked the winner) they are not at all on equal footing cognitively. Even the 52-card variant does not make it likely that the primordial (equally-likely) intuition can be readily displaced by a quantitative probability, only that one primordial qualitative intuition (equally-likely) can be replaced by another (a possibility is unlikely), prompted by an aggressive change in context (from 3 to 52 cards).

And turn now to a very different example of a hesitate/*proceed* default, this time involving professors rather than student subjects. .

*An opportunity cost puzzle*

Ferraro and Taylor (2005) asked economists encountered in the hotel lobby at the 2005 meeting of the American Economics Association to answer a question adapted from Chapter 1 of an introductory text by two particularly well-known economists (Ben Bernanke, as I write chairman of the Federal Reserve Board and Robert Frank of Cornell and a columnist for the New York Times). The question should have been trivially easy for any professor of economics. But catching people as they stroll through a hotel lobby is hardly favorable to extended thought. So here was a context of the sort where even the both-sides-showing version of Wason fools choosers. Nevertheless the result was remarkable. Almost four out of five of this sampling of professional economists got it wrong. FT argued that what that showed was a need for more attention to fundamental concepts in training economists. In a reply, I argued that on the contrary what it showed was that economists are human, hence that economists, like all other human

beings, are vulnerable to cognitive illusions when presented with a question outside of the sort of context in which they are familiar with that sort of question (Margolis 2007).

On the defaulting account, the difficulty comes from the normal pragmatics of language discussed earlier as the *ordinary language* default. By default we treat language as "ordinary" language unless the context pushed us away from that. We know the Earth goes round the sun, but it does not bother us in the least to talk about the sun as "setting" not the horizon as rising, nor does it bother an astronomer. Unless the context triggers him away from the ordinary usage default, the astronomer no more senses anything odd about the sun moving than anyone else.

Here is FT's survey question for economists:

> *You won a free ticket to see an Eric Clapton concert (which has no resale value). Bob Dylan is performing on the same night and is your next-best alternative activity. Tickets to see Dylan cost $40. On any given day, you would be willing to pay up to $50 to see Dylan. Assume there are no other costs of seeing either performer. Based on this information, what is the opportunity cost of seeing Eric?*

And offered a multiple choice of [$0, $10, $40, $50], only 43 of a sample of 199 (21.6%) saw that $10 is the correct response. The number of correct responses from professors of economics, consequently, was somewhat less than the expected number if the respondents had been chickens pecking randomly.

The 80+% who missed the correct response scattered their answers about equally among the three incorrect responses. Subjects relying on their "blink" intuition give what they suppose is a correct response to what was obviously (to a professional) a really elementary question. This turns out to yield what are essentially random responses, but slightly biased *against* the correct ($10) response because it is the only choice not mentioned in the question, hence the least salient to a “blink” guesser. But this does not really show that professors of economics have a grossly inadequate grasp of a routine technical term in their discipline, only that FT's rather odd question happens to trigger the sort of cognitive mechanism that accounts for illusory responses elsewhere. The phrase "opportunity cost" rings a bell for economists. They *know* they know what that means. But in ordinary language it doesn't mean anything. If you combine economists' confidence their intuition would not let them down with a hesitate/*proceed* default, there is the makings of a cognitive illusion here.

In FT's simple problem, you can't go to both the Clapton concert and its alternative because you can't be in two places at the same time, not because (the usual context for economists thinking about "opportunity cost") money to pay for Dylan isn't available for Clapton. What is needed is the opportunity cost of using time in one leisure activity rather than another. And this is also not the value of time issue ordinarily encountered in an economic analysis, which usually trades off value of work vs. value of leisure. Finally, since the out-of-pocket cost for the Dylan concert is zero, nothing prompts a subject to think about the price of the concert, though of course $0 is indeed technically a price though in ordinary language no one would refer to zero as a price. . This combination of odd features makes the problem just a bit "translucent" relative to a question where a person doesn't have to switch dimensions to get to the opportunity cost. The value of the time used to attend the free Dylan concert is the consumer surplus foregone by not going to the Clapton concert for which you have a willingness-to-pay of $50 but need to pay only $40. And although consumer surplus is another perfectly familiar notion to any economist, outside a professional context no one thinks about the consumer surplus you could have gotten from the next-best thing you did not choose to deduce the opportunity cost of whatever you did choose, though indeed that is correct.

The textbook question is a really good one for students. It provokes them to see what at first sight is a weird connection and see why, though weird, it is correct. But as a question outside that tutorial context, it is only weird. The cognitive connection needed to make the correct response readily intuitive is not difficult but it is certainly unusual, so that even though the concepts engaged (opportunity cost, value of time, consumer surplus) are familiar to any economist, the connections among them do not just "click" into place.

Indeed, just as with the various other “neglect” defaults introduced early in this discussion, if an economist were easily prompted to thinking about the opportunity cost of the use of time implications of everyday choices, she could scarcely get though the day. You are almost constantly making choices of what to do next. At each choice, there is something else you might have chosen (or it wouldn't be a choice). Even if a next-best alternative is salient, all you need to know is that you prefer A to B, though every time you choose A there is an opportunity cost from not choosing B. It makes sense that our

brains are organized in a way that inhibits being distracted by contemplation of such questions. It is only under special conditions (here indeed is where training comes in) that focusing on such things as opportunity cost is fruitful.

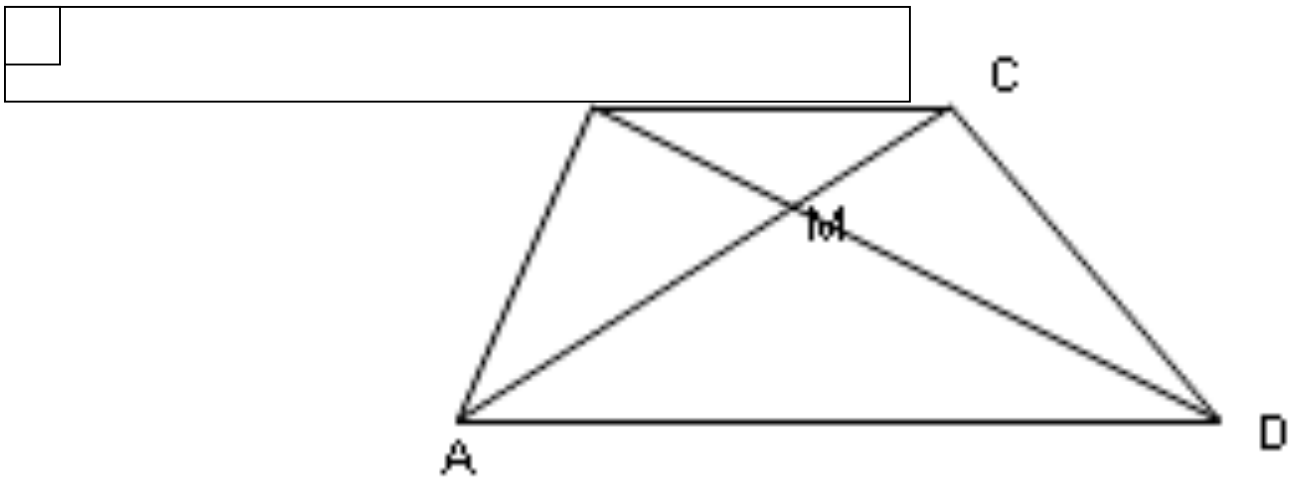
On FT's problem a usually efficient hesitate/*proceed* default pre-empts really simple logic that any economist would know very well. It is logic that most respondents would have had occasion many times to explain to students. But they do not notice what they know very well. FT's startling result ought to sharpen alertness to the possibility that more serious situations must arise where cognitive effects yield bad choices by people who certainly know better./8

But in a real situation that turns on opportunity costs, competent economists will not reveal gross ignorance of what they must in fact know, and if there were real consequences of the technical error for experts described in note.15, it certainly would have been caught very early, not survived for 400 years. Adverse defaulting can prompt cognitive illusions. But the defaults are usually only sticky, not locked in place. Sooner or later everyone comes to see the right answer to 3-card*s* or Monty Hall. But in the realm of judgments beyond the scale of artificial puzzles, more serious consequences can arise, for there contexts are not so simple as to allow a flat, no qualifications, verdict of "error", and other aspects of social contexts add further difficulty. We have reason to consider the possibility that cognitive illusions of the individual choice sort we have been examining in this chapter might have counterparts at the level of social judgment.

And, pointing to the sequel to the argument here, a reader might not be surprised that this source of cognitive difficulty turns out to play a large role when the discussion of defaulting is extended from puzzles put to individuals to the more complex contexts of choice among interacting actors.

*Geometry (8th grade level)*

And lest non-economists feel too smug, consider this quite trivial geometry puzzle. Within the trapezoid (next page), is ΔABM the same area as ΔCDM? Prove your answer is right. Hint: the proof is trivial, though few people solve it without considerable effort. See the note/9 for the proof and a comment on how the quite astonishing difficulty of this simple puzzle relates to neglect defaulting.




NOTES

1.What has become the classic example is Kahneman & Tversky's "taxi" problem. See the still-instructive debate in Behavioral and Brain Sciences (Cohen et al 1981), where -- as elsewhere in discussions of this problem -- prominent, highly qualified academics go carefully through the Bayesian calculation to show they grasp it perfectly, then endorse the illusory base-rate neglecting common intuition anyway.

2. The main exception to claims turning on difficulty with modus tollens is Laming's (Gebauer & Laming 1997), where subjects misread the rule, responding as if "if the letter side has an A… " means "if the first side has an A… ", yielding choices that would coincide with what would occur if modus tollens is neglected in the way proposed here. So the question of why a huge majority miss the simple logic is replaced by the question of why a huge majority misread the simple language. But f in fact a modus tollens neglect default is in play, subjects will behave as if they misread the question.

3. Early on Wason & Johnson-Laird (1972) found strong remedial effects in an experiment (RAST) using repeated choices from sets of not-p and not-q cards. But they did not try the simpler manipulation here of just removing the two easy cards from the usual 4-card display. A reader familiar with my 1987 discussion of Wason will notice that it was also in terms of defaulting, but with respect to a categories/instances pair.
4. The problem has been a favorite among statisticians for a long time. It was published at least as far back as 1889, in a version that postulated three boxes, each with two drawers, one containing a gold coin in each drawer, a second with silver coins, and the last one gold and one silver. The discussion here elaborates on Margolis (1996, Ch. 3), where it was presented in terms of 3 poker chips with red and white dots on the sides. The problem was bought to the attention of cognitive psychologists by Falk & Bar Hillel (1982)

5. I am about to suggest accounts of the 1/3, 1/2, and 2/3 choices. But where do the "others" come from? Although a side-issue for this chapter, the account here would interpret them as anchor-and-adjust responses from subjects anchored on one of the three salient choices, adjusted for awareness of other possibilities.

6. The full results are: 1/2 = 24%, 1/3 = 35%, 2/3 = 27%, others = 14%.

7. Three recent Monty Hall discussions are Krauss, & Wang (2003) and Burns & Wieth (2004), and Fox & Levav (2004), all in the Journal of Experimental Psychology (General). Krauss & Wang report a substantial correction of the illusion, but using a "guided intuition" manipulation which is very elaborate compared to the MH* argument here. Burns & Wieth point to a "collider effect" as the key to the difficulty, and indeed this effect is interesting, but it seems to apply as much to XMH as to MH, without causing any difficulty for XMH. Fox & Levav treat a wider range of problems, including the "sides" variation of the three card problem already discussed.

8. Cognitive illusion affecting experts in their domain of expertise can be noticed elsewhere when nothing very important is at risk, or when an issue first arises, or when there is strong motivation to favor the intuition. For 400 years the very best experts in early astronomy (from Kepler through Thomas Kuhn and beyond) uniformly misjudged a very simple technical issue due to a stubborn but logically trivial cognitive illusion (Margolis 1998). But one or another of the side conditions applied to each of the victims of the illusion.

9. Within the trapezoid, $\Delta BAD = \Delta CAD$, since they share a common base and equal altitudes. Subtract the common area $\Delta AMD$, and we are left with $\Delta ABM = \Delta DMC$. How can sophisticated subjects fail to quickly see that? Faced with this really trivial puzzle, nearly everyone responds as if blind to what is in plain sight. What is beyond the two triangles directly in play is neglected. But just this sort of neglect defaulting will play a central role in the account of apparent indifference to reciprocity in Chapter 9. I first encountered this curious problem at a dinner with Robyn Dawes.