SCHRÖDINGER'S CAT

by Conrad McDonnell

As a physicist, I am sometimes asked by colleagues to explain Schrödinger's Cat. The eponymous cat comes up occasionally in litigation (for example, see *Kleinwort Benson Ltd v. Lincoln City Council* [1998] UKHL 38, [1999] 2 AC 349 per Lord Hoffmann at [121]) due to its useful property of being alive and dead at the same time.

Professor Schrödinger (who is an honorary Briton: his grandmother was English and the cat proposition was developed while he was a fellow at Magdalen College, Oxford) intended the cat as a colourful way to explain one of the deep mysteries in science. The mystery is this: very small (quantum sized) objects such as electrons exhibit wave-particle duality. Left to their own devices, they are in fact waves: so they move like waves in ripples, and if enclosed inside boundaries they resonate like sound waves in an organ pipe. If they have several possible places where they can be, then they are in all those places at the same time, in the same way that a wave fans out as it moves along. The human mind, trained by everyday experience (and Sir Isaac Newton) that things are generally to be found in one place at a time and should move from point to point in nice straight lines, rejects this notion and insists there must be some other explanation: the particle must 'really' be in one place or the other, we just don't have a way to know which it is. That is incorrect. The particle really is a wave, it really is in many places at once, at least until something happens to crystallise its position.

In Schrödinger's experiment (we should emphasise that it was a thought experiment only: had it been a real experiment, that would have been (a) not very kind to the cat, and (b)

potentially difficult to repeat) a cat is placed in a soundproof box. An apparatus is set up where a quantum sized object has a 50/50 chance of being in state A or state B, and the wave theory dictates that the object is in both states at the same time: as a wave, it is in a blend of both states. The apparatus will release poison if it detects the object in state B. Schrödinger posited that the whole system is therefore 50% in state A (where the cat is alive) and 50% in state B (where the cat is not alive) – until the experimenter crystallises the state of the cat by opening the box to find out which it is. This is not a scientific way of saying "we don't know which of these two things it is". That is not the point of the thought experiment. The point of it is to try to explain that, at least at the level of the smallest objects, it really is true that they are in a blend of both states at the same time. And if true at that level, then why not also true of the cat, so long as the box remains closed? Or, as Professor Schrödinger wrote, "The psi-function of the entire system would express this by having in it the living and dead cat (pardon the expression) mixed or smeared out in equal parts."

While Schrödinger, or at least his cat, has now been immortalised, unfortunately, the cat is a terrible analogy for what is really going on in science. Logic, and practical experience, tells us that cats are either alive or dead and so the mind militates against the truth, that the quantum object genuinely is in both states at the same time. Moreover, the thought experiment falsely gives the impression that it is the act of the experimenter opening the box which determines which state the cat is in: it suggests that human beings have some magical property of crystallising quantum states. The proper answer is that the crystallisation happens at an earlier stage, that is the job of the detection apparatus which detects (or doesn't detect) the object in state B.

Or to put it another way: the cat knows perfectly well whether it is alive or dead.

The scientific mystery remains: what really happens when the state of that small object crystallises? How does it go from being in a blend of both states, to being determined as being in one state or the other? Various explanations have been suggested, none of them truly satisfactory. For example one theory is that each time, two alternate universes are created, one where the experimenter sees the object in state A and one where the experimenter sees it in state B – a thoroughly unhelpful explanation of course, as (a) we are only in one universe, our own, thank you very much; and (b) each of those new universes would split in two again the next time the state of an object has to be determined, and that happens rather often, any time any quantum object interacts with anything anywhere, so that makes for rather a lot of universes.

Lawyers, however – in particular, barristers – have an intuitive understanding of this crystallisation process.

To the barrister, looking at a difficult legal problem, both positions are arguable. The strength of the arguments may vary, but it is rare that a proposition is completely unarguable, and it is not uncommon to have a situation where the chances are evenly balanced as what the correct analysis might be. We develop phrases to convey that: "it could go either way", "it depends on the judge", or perhaps best of all "it's a point for the Supreme Court." But until that uncertainty has been resolved by the decision of the court — and in a genuine 50/50 case, that of course means the final resolution of the case, as even after a lower tier court has ruled on the question there is a 50/50 chance of reversal on appeal — the true position is not known. Either of the potential analyses can sensibly be said to be correct, that is to say rational, justifiable, arguable, and a reasonable view to hold. It is a good parallel with Schrödinger's Cat: until you look in the box (by the court making its final ruling) both states are present, that is to say, both have the potential to be the correct answer when that is finally determined.

Clients of course require certainty: commercial decisions must be taken, shareholders must be informed, accounts prepared, tax returns completed, tax liabilities paid. None of these allows for the answer "it's a 50/50 chance". Position A or position B must be chosen, even though the reality is that until the answer has been crystallised by the court, it could be either one.

The tax legislation recognises this reality to some extent. So a tax return may turn out to be incorrect, but not unreasonably so. In that event, the taxpayer may be protected from penalties, and may even be protected from the possibility of HMRC raising a discovery assessment if one of two conditions is met, either the tax return was completed in accordance with generally prevailing practice at the time, or the tax return made full disclosure as regards the uncertain matter, that is to say it took a filing position.

In practice this raises uncomfortable questions of degree. The generally prevailing practice defence may apply only if the universal or at least majority view at the time was in favour of Position A: see *Daniel v. HMRC* [2014] UKFTT 173 (TC), 102 to 112, and there are some indications that that has to be the view of HMRC as well, so that the defence is available only if HMRC's practice has changed, see Daniel paragraph 121. One type of case where the generally prevailing practice defence is certainly available, however, is where the law has changed: so the tax return was filed on the basis of a settled understanding of the law which has been overturned in a subsequent case. The word "practice" rather than "law" is used because the declaratory theory of law dictates that when the court determines what the law is, it is determining what it has always been, so in theory the law has not changed, only the practice has changed – even though the reality is that the law has changed.

In a case where the position is doubtful, a genuine 50/50 case, the generally prevailing practice defence is therefore unlikely to provide any comfort. But a taxpayer can, in

principle, always protect its position by making full disclosure. Full disclosure for these purposes is disclosure so that a hypothetical tax inspector could reasonably have been expected to be aware that the tax declared in the return was insufficient. A difficult question is whether the disclosure has to state clearly the point on which there is uncertainty, in order to be effective disclosure. *Langham v. Veltema* [2004] EWCA Civ 193, [2004] STC 544 would suggest that the uncertainty does have to be clearly disclosed so that the possible underassessment to tax is drawn to HMRC's attention, but in that case it was a point of factual uncertainty: there was a range of possible valuations for the property. More recently in *HMRC v. Lansdowne Partners LP* [2011] EWCA Civ 1578, [2012] STC 544, where if there was any uncertainty it was uncertainty as to a point of law, the Court of Appeal indicated (per Moses LJ at [69]) that "awareness of an insufficiency does not require resolution of any potential dispute." Thus the taxpayer was protected from a discovery assessment by disclosing the facts which were relevant to the position, without drawing to HMRC's attention what HMRC's analysis of those facts might be. However it is significant that in that case the actual inspector of taxes to whom the facts were disclosed realized immediately that there might be a tax liability (although HMRC then failed to open the necessary enquiry into the return without the time allowed for that). Moses LJ indicated that in more complex cases, mere disclosure of the facts may not be sufficient protection: he said, "there may be circumstances in which an officer could not reasonably be expected to be aware of an insufficiency by reason of the complexity of the relevant law."

Since the Finance Act 2014 came into force in July 2014, difficulties in this area have been compounded by the prospect of Follower Notices and Accelerated Payment Notices (APNs). Put shortly, a taxpayer may be disputing his liability to tax, either in an ongoing enquiry or by means of an appeal against

a closure notice in an enquiry which has reached a conclusion – so that in that taxpayer's case, his liability to tax is not yet crystallised – and may yet be compelled to pay an amount equal to the tax in issue, by means of a Follower Notice or an APN. There are additional criteria which have to be met before these notices can be issued, essentially the arrangements in question have to be a marketed tax avoidance scheme or at least arrangements which have been disclosed to HMRC under the DOTAS rules (which is a somewhat wider pool) but I will not go into those criteria here.

A Follower Notice may be issued where HMRC "is of the opinion" that there is a judicial ruling which is relevant to the chosen arrangements: Finance Act 2014, section 204(4). A 'judicial ruling' is defined to include only decisions which have become final, whether because the time for appealing against them has expired without any permission to appeal being sought, or because permission to appeal has been refused, or because they are decisions of the Supreme Court – thus there at least, the statute recognises that certainty is required. However, that impression of certainty is undermined by the language of section 204(4), and the definition of which judicial rulings are relevant, s.205(3) Finance Act 2014, which in practice may give HMRC wide latitude to issue Follower Notices in all cases which in their opinion are covered by a judicial ruling, even if the taxpayer maintains there are grounds for distinguishing his case from that ruling.

APNs may be issued in the case of any arrangements as a result of which a tax advantage is asserted by the taxpayer (for example, by means of claiming relief in a return, or simply appealing against an assessment on the basis that tax is not due), where a designated HMRC officer "determines, to the best of that officer's information and belief" that the tax advantage does not arise from the arrangements: Finance Act 2014, s.220(5). In a case where there is genuine uncertainty as

to whether the arrangements are effective to save tax or not, or genuine uncertainty about what the outcome of an appeal will be, there is an obvious question as to whether it is possible for the designated officer to determine that tax is due "to the best of his information and belief" at all. That is, there may be cases where the true tax position has not been crystallised by the judicial process, so the only fair view is that the tax position is uncertain: it might be one thing, or it might be the other. How, in that situation, can an HMRC officer properly determine that tax is due, before that has been crystallised?

Endnotes

1   At the time, Schrödinger owned a cat named Milton, so we can assume he was in fact fond of cats.

2   Every 11 year old could in fact work this out for himself if he really thought about what his science teacher is telling him. We are taught that atoms consist of electrons orbiting around a nucleus in circles, but also that atoms are spherical: they pack together like balls to make crystals and molecules. If one thinks about it, those two propositions cannot both be correct. If the electrons were orbiting in circles like planets going round the sun, then atoms would be flat discs, or fried-egg shaped. "Aha," you say, but some of the electrons go in one direction and some in another direction so it all rounds out into a sphere in the end. Unfortunately that is still nonsense. Some atoms only have one or two electrons, but they are still perfectly spherical. The reason atoms are spherical is because the electron is, in reality, in all the different places it can be around the atom, at the same time: that is the only possible explanation.

3   Or, where applicable, "for Luxembourg".

4   Finance Act 2007, Schedule 24, paragraph 1: a penalty may be imposed only if the return was "careless"

5   Taxes Management Act 1970, section 29

6   Taxes Management Act 1970, section 29(2)

7   Taxes Management Act 1970, section 29(5)

8   See HMRC's Statement of Practice SP01/09, in particular paragraph 9.

9   *Kleinwort Benson Ltd v. Lincoln City Council* [1998] UKHL 38, [1999] 2
    AC 349 per Lord Goff at paragraphs [50] to [54]: in particular his
    comment that "we should look at the declaratory theory of judicial
    decision with open eyes and reinterpret it in the light of the way in which
    all judges, common law and equity, actually decide cases today."

10 Taxes Management Act 1970, section 29(6)

11 Finance Act 2014, Part 4

12   Finance Act 2014, section 205(4)