Pathologies in which there is a dissociation between behaviour and consciousness or verbal reportability (Following Weiskrantz, 1997).

Amnesia: ability to learn /train behaviour is maintained even without awareness of pastthe learning process or even the behaviour effectively learned. The evolution of learning is comparable to non-amnesic subjects. This distinction between ability and awareness is also present in other memory impairments like **prosopagnosia** in which the inability to recognise subjects at a conscious level is contradicted by the involuntary responses at the body level (for example by differences in skin conductance) when in the presence of familiar faces.

Acquired Dyslexia: A subject unable to distinguish meaningful from non-sense words on a conscious level may distinguish them correctly (in suitable conditions) if asked to discriminate them by chance. The same applies to more specific tasks: "[using forced-choice responding] he could say whether the written name of a country belonged to the inside or outside of Europe, whether the name of a person was that of an author or politician, or whether the name of an object was living or non-living" (Weiskrantz, 1997, p.27. ref. article Shallice and Saffran, 1986). This dissociation also occurs in different kinds of **aphasia**, regarding both semantic and syntactic content (for references see Weiskrantz, 1997, pp.27-29)

Blindsight: Ability to behave as if the external stimuli was detected but with no (visual or any kind of) awareness of the stimuli (in fact this ability to react appropriately was so good that the unawareness passed unnoticed in the first studies of monkeys in which the V1 was ablated). More recently it was found out that the identification of affective expressions could also be made without awareness, which was dubbed **affective blindsight**. (see Gelder, 1999, and Gelder, 2000)

Blind Touch (or numbsense): ability to react to tactile stimuli of which the subject is not aware of the stimuli. For instance a subject is able to 'guess' correctly the location of a tactile stimulus on a numb arm. (see Paillard, 1983, also Rossetti, 1995)

Deaf Hearing: not much explored, see Michael and Peronnet, 1980. Other literature shows that familiars of the patients sometime describe involuntary reactions to sounds in otherwise complete cortical deaf patients, but these cases were not experimentally studied.

Unilateral neglect: Although the subjects deny any awareness of objects in their neglected field, they can nevertheless guess correctly about some of their properties (see Marshal and Halligan, 1988; Bisiach, 1992, Ladavas et al., 1993 (for semantic priming) and Berti and Rizzolatti, 1992 (for visual priming)).

Anasognosia: In all the previous cases the "subject may not 'know' it, but some of part of the brain does" (Weiskrantz, 1997, p.26). In this case, there is still a dissociation between function and awareness, although we observe the inverse relation: the subject consciously maintains he continues to possess an ability that he no longer maintains (for example in blindness or paralysis).

Some details about blindsight:

The study of blindsight started wit the disparate results between the results of V1 dysfunction in humans and in other primates. Although other primates showed to have retained some visual abilities even in the complete absence of V1, humans seemed to show complete blindness. At first, this was taken to suggest structural differences between the human and primate visual system. But it soon was realised that, for some human subjects suffering from V1 inactivity, if placed in the same kinds of tests that primates were exposed, the results would be similar.

With the advancement of studies in human subjects it was found that there are two modes in which an object can appear to a subject:

- Subjects feel some characteristic of the object (moving for instance) but they don't see it moving. It's not a visual kind of awareness, although we can say that there is awareness. This is not considered blindsight.
- Subjects don't have any feeling at all regarding the visual stimulus (they don't even know that there is a visual stimulus) although, when prompted to guess, they perform well above chance. Only this completely unaware mode is considered blindsight.

On the other hand, the range of abilities that remains functional despite hemianopia differ from subject to subject (not all subjects demonstrate blindsight): "subjects with V1 damage have been reported who are able to, in their blind hemifields, to detect the presence of stimuli, to locate them in space, to discriminate direction [or existence] of movement, to discriminate the direction of lines, to be able to judge whether stimuli in the blind hemifield match or dismatch those in the intact hemifield, and to discriminate … colours" Weiskrantz, 1997, p.23.

Theoretical importance:

1. Blindsight shows that consciousness is something that can be studied by scientific experiments in laboratorial conditions. New experiments on blindsight involving animals show that these experiments can be redesigned in a way to show if animals are in fact experiencing objects or just making forced choices.
2. On the other hand, some limits on experimentation are also imposed. For instance, in a study made to access musical appreciation despite of partial cortical deafness, it was assessed that musical appreciation did exist since the subject could choose among several tunes which were more pleasing. Experiences like blindsight show that results based on forced choice decision can yield unintended results since subjects can still guess correctly even without awareness that they are doing so.
3. An understanding of the mechanisms that explain the dissociation between function and awareness will suggest candidates for theories of consciousness. Weiskrantz, for instance, is striving to determine, in his more recent experiments on blindsight, the neural correlates of consciousness (NCC).
4. The necessity of using choice to extract correct results from the blindsight field of subjects might suggest a function for consciousness.
5. There are some consequences to the current philosophical dicussion since blindsight results do not seem to support the widespread philosophical functional view of mental states.

Blindsight in normal subjects.

Although blindsight is mainly studied in cortical blind subjects, there are other experiences where similar results are claimed. An experience far from blindsight but with somewhat parallel results can be provoked by subliminal stimulation (for an example see internet site: http://serendip.brynmawr.edu/bb/blindsight.html). However is not entirely clear that this example qualifies for blindsight. It depends a lot on the definition and the aetiology we attribute to it. If we consider that blindsight is caused just by an unconscious discrimination then the qualification might apply, however, considering that blindsight patients do not use V1 for visual processing on the blind hemifield, we might decide to disregard subliminal stimulation as an instance of blindsight. This question os strongly related to knowing whether blindsight can be explained just by the faintness of the stimuli.

Another much more interesting example was given in an article by Kolb and Braun (1995) where carefully chosen stimuli were selected in a way that they would not arrive to the V1 area for processing, but would arrive at other areas of the brain. By using this stimuli they were able to replicate blindsight results in subjects with normal visual abilities. (see Kolb and Braun, 1995, "Blindsight in normal observers", *Nature*, 377, Sep(28):336-8.

Two proposed explanations of blindsight.

1. Strength of signal hypothesis (connection with subliminal stimuli). According to this hypothesis blindsight experiments would be very similar to those using near threshold experiments (with faint or very fast stimuli). Weiskrantz is against this view both on the theoretical level since he prefers the NCC approach: "I do not know why awareness should emerge once a given level of strength has been reached" p.40, and on experimental results since "blindsight performance can reach and remain at high levels, 90 to 100% correct, well outside the range of performance in the shadowy domain of near-threshold levels of psychophysics with normal subjects" p.39. Also, it was found that the blindfield is "better than the intact hemifield in actually detecting a visual stimulus, again, by guessing. (Weiskrantz, 1986)" p.40. Another evidence against this hypothesis is that blindsight patients light up different areas of the brain in fMRI scans.
2. Another hypothesis is much more close to the idea that there are in the brain specific locations associated with awareness (a view that supports the attempt to find the so-called NCC). According to a widely held view we can distinguish two kinds of perception: The first that is perception for making explicit (**conscious**) judgements ***versus*** perception that directly commands **action** (does not require consciousness). According to these authors neural paths coming from the striate cortex can give origin *either* to conscious perceptions – if they end up in the temporal lobe (using the *ventral stream*) – *either* to action-guiding (unconscious) perception (using the *dorsal stream*) – if they end up in the parietal lobe. (see Goodale et al., 1994 and 1995).

Actually, much of the work that is now being done in blindsight has to do with identifying the paths used in the blind hemifield when in blindsight mode, and also to disproving the idea that blindsight might be explained by small areas of V1 that might have remained intact. However only blindsight patients have been studied, it would be important to compare these subjects to patients without V1 activity but also without blindsight.

My presentation will now focus on an **article analysis** in which a typical blindsight experiment is analysed. The article in question is:
Sahraie, Weiskrantz and Barbur, "Awareness and confidence ratings in motion perception without geniculo-striate projection", *Behavioural Brain Research,* 1998, 96:71-7.

The tests were made on a subject GY which has been tested on many other times (since at least 1980) and for different teams (and in different countries). "The 41 year old subject investigated in this study has a right homonymous hemianopia as a result of the damage to the geniculo-striate pathway in a traffic accident when he was 8 years old." p.72

The experiment consisted in projecting a laser beam moving into either a vertical or horizontal direction. The subject had his eyes concentrated on a fixed point (this was monitored) so that the beam of light was always inside of his blindfield. Also, there was certainty that there was no scattering of light in the eye capable of transmitting any information to the opposite hemifield. (In later studies it was also has been made sure that noises from the motor of the laser beam were not unconsciously used in the guessing, by masking all eventual sounds with white noise.) Also, due to the statistical nature of the results each trial (at a certain laser speed) was repeated 50 to 200 times (each trial demands 2 minutes to provide adaptation to lighting conditions, plus 14 to 6.3 seconds of the actual experiment).

After each particular trial GY had to report three things: if the movement of the beam was made in the horizontal or vertical direction, if he had some kind of awareness and if he had confidence in the result. One of the objectives of the experiment was to see if a replacement of the traditional Yes/No option by a 6 level scale would produce some difference in the results. The authors remarked that there was no such substantial difference found, but we will see that there seems to be a problem with this assessment.

It must also be said that, in the particular case of GY, if laser speed is too high, GY becomes non-visually aware of the speed. This is already well-know in the literature. On the other hand, GY "sometimes reported that although he was definitely not aware of the stimuli, he felt confident that he had made a correct choice after he reported it." p.72 This distinction between awareness and confidence is something, as far as we know, a novelty introduced by this article.

So there are three possible results of each trial: pure guessing without any kind of awareness (of the stimulus) or confidence. Then guessing with confidence but still without any kind of awareness. And finally choosing the appropriate reply with some kind of non-visual awareness and confidence.

What the results show is, expectedly, that GY's performance augments in a way directly proportional to the speed of the beam. This includes discrimination ability, confidence and awareness. At speeds equal or slower than 2.5° per second GY always reports that he is (visually or non-visually) unaware of the stimulus. However, even in the slower speeds there are always some instances where GY reports confidence (for instance at 1.75° per second there are 34% of trials that were made with confidence).

Reports just on confidence, just on awareness, or where the subject has to make both assessments in a single experiment do not express the same performance. In general, if the subject has to make a double assessment he will have worst performance.

Main problem of the article: is the changed awareness curve a result of "an increase in the subject's blindfield motion sensitivity" p.77 or, by the contrary, the expression of a bias caused by passing from a binary (y/n) alternative to a rated scale?