

# 'Dorsal stream dysfunction' and 'dorsal stream dysfunction plus': a potential classification for perceptual visual impairment in the context of cerebral visual impairment?

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A large proportion of the brain is devoted to vision, so it is not surprising that visual processing is commonly affected when the brain is damaged. The classical model of understanding is that image data from the retina are transferred via the optic nerves and lateral geniculate bodies to the occipital cortex where the picture is 'seen'; and damage to this system leads to loss of visual field and reduced visual acuities. However, impairment of higher visual processing is also common and may easily go unrecognized or may be misdiagnosed, but there are typical behavioural features, easily elicited by structured history taking and validated by observation of behaviour and testing, which lead to the diagnosis.<sup>1</sup> Strategies can then be designed to meet the needs of each child.<sup>2</sup>

Two principal higher visual pathways have recently been described, namely the dorsal stream and the ventral stream.<sup>3</sup> The dorsal stream passes between the occipital lobes and the posterior parietal lobes. This brain unit serves the functions of appraising the whole visual scene, and (along with the frontal lobes) attending to elements within the scene. It facilitates immediate visual guidance of movement through the scene, by interacting with area V5 (or the middle temporal lobes MT), the area of the brain responsible for processing perception of motion. The dorsal stream system is automatic and unconscious. It is 'on-line' and is not memory based. Damage in this brain territory is associated with a range of visual behaviours described in Table I.

The ventral stream passes between the occipital lobes and the temporal lobes where the 'image libraries' are stored. The recognition of faces, shapes, objects, and routes is attained by matching what is seen, with what is stored in the 'library'. A match leads to recognition. Table I outlines the visual problems resulting from damage to this territory. In children, dorsal stream damage is seen more frequently than ventral stream damage.

The symptom complex of dorsal stream dysfunction, which is associated with a range of pathologies affecting the posterior parietal area, ranges in character and severity.

It may be associated with slightly or significantly impaired visual acuities and visual fields, and may also be associated with varying degrees of cerebral palsy. It has recently been shown to be common in children with periventricular white matter injury,<sup>4</sup> those born very preterm,<sup>5</sup> and in those with Williams syndrome.<sup>6</sup> Ventral stream dysfunction is seen less frequently and there is usually concomitant dorsal stream dysfunction.

A specific symptom complex of dorsal stream dysfunction is emerging, which comprises difficulty handling the complexity of a visual scene (of varying degree) and which may include impaired visual guidance of the limbs (optic ataxia), possibly associated with reduced visual acuities, homonymous visual field impairment (particularly inferiorly), and occasionally additional impaired recognition (which could be considered as 'dorsal stream dysfunction plus'). The paper by Ortibus et al. in this number of the journal adds further objective evidence to support the existence of this emerging symptom complex of perceptual visual impairment which is specific to children and results from a wide range of brain pathologies.

## REFERENCES

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**Table 1:** Typical behavioural features of perceptual visual impairment in children due to dorsal and ventral stream dysfunction, and an outline of possible strategies to help. Modified from Dutton et al.<sup>7</sup>

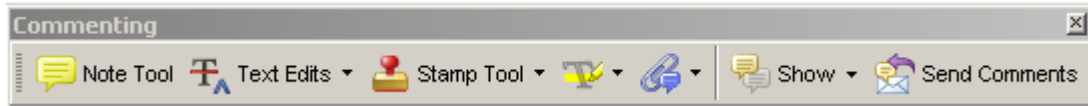
Features	Strategies
<b>Dorsal stream dysfunction</b>	
<i>Difficulty handling the complexity of the visual scene causes problems:</i>	
Finding a toy on a patterned background	Use plain bed spreads and carpets
Finding a toy in a toy-box	Store toys separately (with linear storage)
Finding clothes in a drawer or in a pile	Store clothes separately in compartments
Seeing a distant object (as there is more to see)	Get close. Reduce clutter around blackboard
	Share screen of a digital/video camera
Finding someone in a group	Wear bright clothes, wave, and speak
	Adopt buddy or similar strategy for playground
Getting lost in crowded places	Training in seeking and recalling landmarks
Distress in crowded locations	Arrive at parties early
	Go shopping when quiet
Reading	Enlarge and space out text. Mask surrounding text
	Wear full spectacle correction for hypermetropia to gain magnification. Use magnifiers
<i>Difficulty with visual guidance of movement causes problems:</i>	
With inaccurate reach and grasp	Use tactile guidance with other hand as part of occupational therapy
	Reach beyond and gather up
Difficulty walking over uneven ground and steps despite viewing directly and good motor function	Provide tactile guidance to the height of the ground ahead, such as using a toy pram or allow to hold on to clothes of an accompanying person (while pulling down)
<i>Difficulty 'dual tasking' causes problems:</i>	
Bumping into obstacles when talking while walking	Limit conversation when walking
Marked frustration when distracted from task	Limit background clutter and activity
<b>Ventral stream dysfunction</b>	
<i>Difficulty with recognition causes problems:</i>	
Recognizing people and knowing who is unknown	Family and friends introduce themselves and wear identifiers
Understanding the language of facial expression	Language is used to explain emotions
Recognizing shapes and objects and their alignment	Include training in tactile recognition using blind methods
<i>Difficulties with orientation cause problems:</i>	
Navigating inside the house	Use colour coding for doors
	Put footprints on the floor to follow
Navigating outside	Create songs and poems for routes

## USING E-ANNOTATION TOOLS FOR ELECTRONIC PROOF CORRECTION

### Required Software

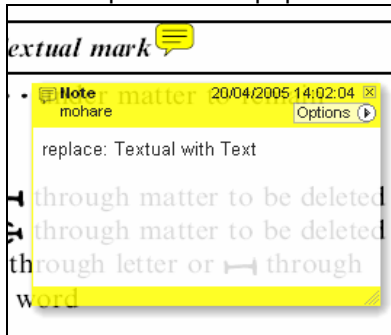
Adobe Acrobat Professional or Acrobat Reader (version 7.0 or above) is required to e-annotate PDFs. Acrobat 8 Reader is a free download: <http://www.adobe.com/products/acrobat/readstep2.html>

Once you have Acrobat Reader 8 on your PC and open the proof, you will see the Commenting Toolbar (if it does not appear automatically go to Tools>Commenting>Commenting Toolbar). The Commenting Toolbar looks like this:



### Note Tool — For making notes at specific points in the text

Marks a point on the paper where a note or question needs to be addressed.

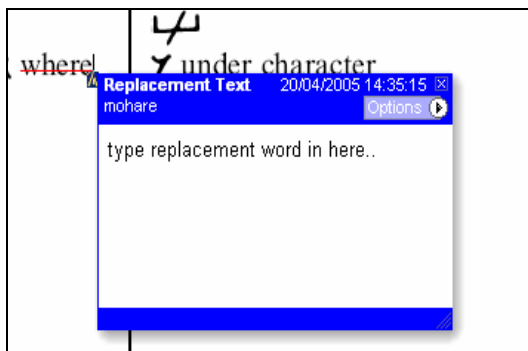


#### How to use it:

1. Right click into area of either inserted text or relevance to note
2. Select Add Note and a yellow speech bubble symbol and text box will appear
3. Type comment into the text box
4. Click the X in the top right hand corner of the note box to close.

### Replacement text tool — For deleting one word/section of text and replacing it

Strikes red line through text and opens up a replacement text box.

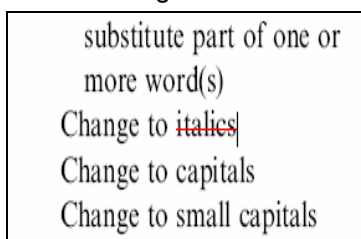


#### How to use it:

1. Select cursor from toolbar
2. Highlight word or sentence
3. Right click
4. Select Replace Text (Comment) option
5. Type replacement text in blue box
6. Click outside of the blue box to close

### Cross out text tool — For deleting text when there is nothing to replace selection

Strikes through text in a red line.



#### How to use it:

1. Select cursor from toolbar
2. Highlight word or sentence
3. Right click
4. Select Cross Out Text

### Approved tool — For approving a proof and that no corrections at all are required.

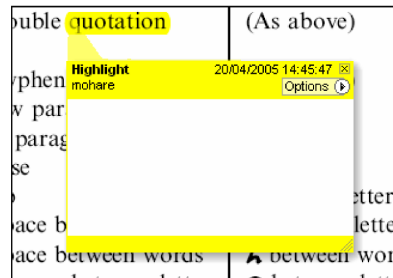


#### How to use it:

1. Click on the Stamp Tool in the toolbar
2. Select the Approved rubber stamp from the 'standard business' selection
3. Click on the text where you want to rubber stamp to appear (usually first page)

## Highlight tool — For highlighting selection that should be changed to bold or italic.

Highlights text in yellow and opens up a text box.

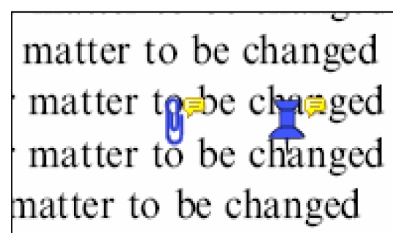


### How to use it:

1. Select Highlighter Tool from the commenting toolbar
2. Highlight the desired text
3. Add a note detailing the required change

## Attach File Tool — For inserting large amounts of text or replacement figures as a files.

Inserts symbol and speech bubble where a file has been inserted.

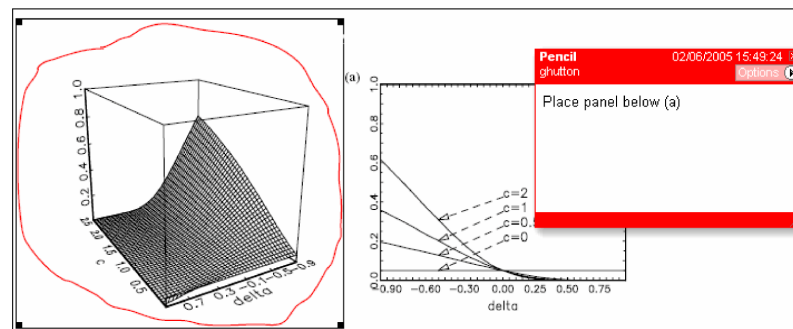


### How to use it:

1. Click on paperclip icon in the commenting toolbar
2. Click where you want to insert the attachment
3. Select the saved file from your PC/network
4. Select appearance of icon (paperclip, graph, attachment or tag) and close

## Pencil tool — For circling parts of figures or making freeform marks

Creates freeform shapes with a pencil tool. Particularly with graphics within the proof it may be useful to use the Drawing Markups toolbar. These tools allow you to draw circles, lines and comment on these marks.



### How to use it:

1. Select Tools > Drawing Markups > Pencil Tool
2. Draw with the cursor
3. Multiple pieces of pencil annotation can be grouped together
4. Once finished, move the cursor over the shape until an arrowhead appears and right click
5. Select Open Pop-Up Note and type in a details of required change
6. Click the X in the top right hand corner of the note box to close.

## Help

For further information on how to annotate proofs click on the Help button to activate a list of instructions:

