

Eye Movements in Programming Education

Coding scheme:

Tier/Category	Code	Description	Classification
Block	Attributes, Constructor, Height, Main, Width	General area in which fixation occurs, e.g. a main-method, the height-method etc.	Observable
SubBlock	Body, Return, Signature	Specific region of the general area in which fixation occurs, the signature, the line containing the return-statement or the body	Observable
Signature	FormalParameterList, Name, Type	Precise code section	Observable
MethodCall	ActualParameterList, Name, Type	Precise code section	Observable
Pattern	JumpControl, Linear, LineScan, Scan, Signatures	<p>JumpControl: Subject jumps to the next line according to execution order</p> <p>Linear: Subject follows text line by line, for at least three lines, no matter of program flow, no distinction between signature and body.</p> <p>LineScan: Subject reads a whole line, all elements in rather equally distributed time. (LineScan and Linear can occur in combination.)</p> <p>Scan: Subject first reads all lines of the code from top to the bottom briefly, and then concentrates on some particular portions. (Uwano et al. 2006 found that in the first 30 % of the review time a preliminary reading of the whole program occurs.)</p> <p>Signatures: Subject looks at all signatures first, before looking into method/constructor body.</p>	Observable

Strategy	<p>Debugging, DesignAtOnce, ProgramFlow, TestHypothesis, Trial&Error</p>	<p>Debugging: Similar to DesignAtOnce, but more equally distributed fixation durations, and more equally distributed time of fixation for all text elements. Based on pattern Linear and LineScan. The subject's intention is to find syntactical or semantic errors.</p> <p>DesignAtOnce: Linear or Scan, hardly any jumps back. The subject's intention is to understand the general or the algorithmic idea, without having the need to go into details. Can easily be confused with excessive demand/trial and error, might also include TestHypothesis on local levels.</p> <p>Program flow: (Scan) → Main → Jump-Control or Linear → Main → JumpControl. The subject's intention is to understand how the program executes / or figure out the outcome of the program.</p> <p>TestHypothesis: Repetition of a pattern or gaze path. Occurs in connection with "design at once" or program flow. The subject's intention is to check for some details in understanding. Hints at some issue where either the person was distracted, or which is more difficult to comprehend.</p> <p>Trial&Error: Similar to DesignAtOnce, but with higher reading speed, and some irregular jumps and repetitions in reading. The subject's intention is to cope with cognitive overload and to try to find some place to start the understanding process.</p>	Interpretation
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