

Many factors, having little or nothing to do with the ability of the computer to efficiently compile and execute the code, contribute to readability. Use of a static code analysis tool can help detect some possible problems. It affects the aspects of quality above, including portability, usability and most importantly maintainability. Different programming languages support different styles of programming (called programming paradigms). Code-breaking algorithms have also existed for centuries. Allen Downey, in his book *How To Think Like A Computer Scientist*, writes: Many computer languages provide a mechanism to call functions provided by shared libraries. In 1206, the Arab engineer Al-Jazari invented a programmable drum machine where a musical mechanical automaton could be made to play different rhythms and drum patterns, via pegs and cams. Methods of measuring programming language popularity include: counting the number of job advertisements that mention the language, the number of books sold and courses teaching the language (this overestimates the importance of newer languages), and estimates of the number of existing lines of code written in the language (this underestimates the number of users of business languages such as COBOL). Trade-offs from this ideal involve finding enough programmers who know the language to build a team, the availability of compilers for that language, and the efficiency with which programs written in a given language execute. However, readability is more than just programming style. By the late 1960s, data storage devices and computer terminals became inexpensive enough that programs could be created by typing directly into the computers. Sometimes software development is known as software engineering, especially when it employs formal methods or follows an engineering design process. Popular modeling techniques include Object-Oriented Analysis and Design (OOAD) and Model-Driven Architecture (MDA). Various visual programming languages have also been developed with the intent to resolve readability concerns by adopting non-traditional approaches to code structure and display. Debugging is often done with IDEs. Standalone debuggers like GDB are also used, and these often provide less of a visual environment, usually using a command line. Integrated development environments (IDEs) aim to integrate all such help. Many programmers use forms of Agile software development where the various stages of formal software development are more integrated together into short cycles that take a few weeks rather than years. Following a consistent programming style often helps readability. As early as the 9th century, a programmable music sequencer was invented by the Persian Banu Musa brothers, who described an automated mechanical flute player in the *Book of Ingenious Devices*. Machine code was the language of early programs, written in the instruction set of the particular machine, often in binary notation. Some of these factors include: The presentation aspects of this (such as indents, line breaks, color highlighting, and so on) are often handled by the source code editor, but the content aspects reflect the programmer's talent and skills. Some text editors such as Emacs allow GDB to be invoked through them, to provide a visual environment. Languages form an approximate spectrum from "low-level" to "high-level"; "low-level" languages are typically more machine-oriented and faster to execute, whereas "high-level" languages are more abstract and easier to use but execute less quickly. The choice of language used is subject to many considerations, such as company policy, suitability to task, availability of third-party packages, or individual preference. It involves designing and implementing algorithms, step-by-step specifications of procedures, by writing code in one or more programming languages.