

# Reception of Pascal in the history of sciences...

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## **Abstract**

In particular computer science and technologies.  
With references to the history of philosophy  
and the social sciences.

## I - Crown jewel computers, and sciences

The computer scientist Niklaus Wirth, creator of the Pascal programming language, has said of the origins of his creation :

I named it after the French philosopher and mathematician, who in 1642 designed one of the first gadgets that might truly be called a digital calculator.<sup>1</sup>

This is how Wirth remembered Pascal, and explained his choice of the philosopher for his namesake language in 1993 as part of a large conference organized by the ACM on the history of programming languages (the second HOPL);

as a pioneer in a line from which – it is either implied, or we interpret too strongly – he ultimately descended.

Another notable computer scientist, Friedrich Bauer, known for the stack ADT and his participation in the making of ALGOL 60<sup>2</sup> among others, in his 'Historical notes on computer science' (one of his last books, if not the last) expressed the following judgment on Pascal and Schickard :

“We would not do Schickard any justice by exaggerating : his calculating machine was no 4-type [”Vier-Species”] machine, like that of Leibniz, but only a 2-type like Pascal’s, but with the difference of having come twenty years earlier. Kepler was said to have been most happy with it. And, perhaps its mechanism was superior. But, that would be a detail.”<sup>3</sup> [trans.]

Ergo : the real machine was Leibniz’s – as it could (really) do all four operations of arithmetic – and as for the earlier, partial or lesser, ones Schickard’s

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<sup>1</sup>Found in *History of programming languages*, vol. 2.

<sup>2</sup>From which Wirth would draw inspiration for Pascal.

<sup>3</sup>Bauer 2009 : 67.

came first and might have been even better. (One way or the other, a German inventor had precedence.)<sup>4</sup>

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We can extend this analysis to the wider history of sciences, and those of Pascal's scientific activities outside mechanical computers, by citing this study picked from many others :

"The most imaginative and influential experimental philosopher of the decades after 1650 was the Englishman Robert Boyle (...)

The so-called 'crucial' experiment whereby the brother-in law of the French mathematician, Blaise Pascal (1623-62), proved the existence of air-pressure by observing the different heights attained by a column of mercury at the bottom and top of the Puy-de-Dome, a mountain in central France, was only performed once. Pascal's purported confirmation of the experiment using the tower of the Paris church Saint-Jacques was wishful thinking: given the altitude of the building"

writes this professor from Oxford (and fellow Englishman?)<sup>5</sup>.

## II - Origins of a priority fight

When looking for the beginnings of the Schickard-Pascal priority debates, we should probably look no further than the *Encyclopédie*.

Diderot and d'Alembert, as editors, included the Pascaline in the very first volume of their encyclopedia, under "arithmetique"<sup>67</sup>; Published in 1751 :

"The first machine for arithmetic is by Blaise Pascal, born in Clermont

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<sup>4</sup>Pascal is mentioned about 15 times in this text (same-named programming language excluded).

<sup>5</sup>Brockliss 2001 : 155.

<sup>6</sup>The sub-definition "ARITHMETIQUE (machine)" esp..

<sup>7</sup>(It takes something like the mind of a hacker to find it there. (Searching under P is useless, except maybe for 'Paschal' meaning, as it is defined there, "that which concerns the Easter of ... Christians".))

in Auvergne [date]; he created it at 19. More have appeared since, which, in the opinions of the gentlemen from the Academy of Sciences themselves, appear to have advantages over it, but his [Pascal's] is the oldest ; it might have served as model for all others : hence why we have opted for it.”

To give a measure of this work's importance : Pascal was now, he and his Machine, part of the most famous encyclopedia of all : “the encyclopedists had produced the most massive single reference work in Europe to date.”<sup>8</sup>

Said introduction of the machine was followed by a very lengthy and detailed description of its operation (multiple pages, in the original).

This remained the dominant view until the research and publications of Franz Hammer, Max Caspar ('Kepler's biographer'), the reconstructions by von Freytag Loringhoff... [of which enough has been said to not repeat here]

### III - Pascal, a programming language

*” The programming language Pascal was designed in the years 1968-1969 ... The first compiler for Pascal was operational in early 1970”*

Niklaus Wirth, creator of the programming language Pascal.

On the more sociological aspects of his choices (i.e. its pedagogic, professional dimensions), Wirth wrote :

*“Pascal was born in 1969 out of an act of liberation. ... Confronted with the duty to teach programming, I had been faced with the dire*

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<sup>8</sup>Dewald (ed.). Vol. 2. [If descriptions like “The encyclopedists' goal was to make available to the greatest number of readers the most complete account possible of all current knowledge” sound somewhat like the Internet and Web, it's not without cause : tens of thousands of articles and hundreds of collaborators, “*Parisians, provincials, and foreigners, the encyclopedists were a heterogeneous group*”]

*options of Fortran and Algol. The former did not appeal to my taste as a scientist, the latter not to those of the practical engineer.”*

Its origins can however be identified as earlier :

In 1966, Wirth together with Hoare published 'A contribution to the development of ALGOL' whose abstract held

“A programming language similar in many respects to ALGOL 60, but incorporating a large number of improvements based on six years' experience with that language”<sup>9</sup>

Wirth would later refer to this earlier work as “a direct predecessor of Pascal”.

*“This language is a direct predecessor of Pascal, and was the source of many features such as e.g. the while and case statements and of record structures”.*<sup>10</sup>

It was in that same article from 1971 that Pascal was introduced to the world, with the words :

*“A programming language called Pascal is described”.*<sup>11</sup>

It is worth noting that nothing seems to have been included in this article on the origins of the name for this programming language.<sup>12</sup>

Wirth did not consider this an object of interest. The philosopher was obviously implied?

When did computer scientists and technologists start naming their programming languages after philosophers? Personalities? Fellow engineers, and their ancestors (e.g. **Ada**, derived from Pascal)?

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<sup>9</sup>Wirth/Hoare 1966.

<sup>10</sup>Wirth 1971 : 123.

<sup>11</sup>Wirth 1971 : 122.

<sup>12</sup>The same goes for *Algorithms...* in the Pascal version (Wirth 1976), the “User manual and report” (Jensen/Wirth 1974) and Wirth 2002 so far we can tell.

Bertrand is a later example following this convention.

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As for the wider intellectual context in which Pascal was created, it can be found in the “structured programming” theories of Edgar Dijkstra and the work of Hoare :

Dijkstra is the very first person mentioned in Wirth’s book Algorithms + Data structures = Programs (after Pascal), followed by Hoare.

Wirth himself described his programming language as “*designed ... with a ... syntax representing the paradigm of structured programming*”<sup>13</sup>.

In *Algorithms*, still, he made clear that :

“Throughout the book ... we follow the theory and terminology expounded by Hoare and realized in the programming language PASCAL.”<sup>14</sup>

having previously cited Hoare’s “Axiomatic Basis of Computer Programming” and, in this passage, “Notes of Data structuring”.

#### IV - Early social scientist (On Durkheim’s reception)

Durkheim, philosopher turned sociologist, occasionally referenced Pascal in his earlier philosophy lessons<sup>15</sup> all the while not seeming to have much affection for him — or most philosophers, for that matter.

His philosophy is almost entirely discarded :

“*With Pascal we c[ould] say that we know everything of nothing*”, i.e. that there is nothing that we know entirely, yet, Durkheim goes on, “*this has little*

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<sup>13</sup>Wirth 2002

<sup>14</sup>Wirth 1976 : preface.

<sup>15</sup>About 10 mentions in a circa 300 pages text (these lectures come to us in the form of notes taken by a former student, and should thus be considered with some caution.)

*importance, because”, according to Durkheim, “it is enough for us to know some few things to not let us be discouraged.”*

As for his science :

“Many ideas that seem obvious [”necessaire”] to us today were not so yesterday. Pascal did not believe in the law of gravity for instance.”

His experiments with barometers are cited as an example of induction (as part of a larger expose on induction and its weaknesses).

The ”amulet” is mentioned as Durkheim references Lelut’s work on folly (whose study on Pascal concluded he was insane?)...

Stuart Mill is never far away from Pascal in those developments, a reference that seems to mostly serve the function of extension or ”betterment” of Pascal (Mill, who, ultimately also ends up being regularly rejected).

But, was Durkheim all the more keen on distancing himself from these philosophers as he was preoccupied with founding his new science – sociology – as independent from philosophy? And, all the more from Pascal as he was doing so in the specific context of his own country?

## **V - Modern philosophy, popular culture**

Where computers and philosophy are concerned one work in particular stands out, which are the Matrix movies.

Two volumes, published in short succession, had been groundbreaking in their own way for attempting to discuss this work from the standpoint of philosophy : *The Matrix and Philosophy...* and *Taking the Red Pill*.<sup>16</sup>

Descartes was prominently featured, in too many mentions to count(!), and in fact it was with him that the first of these books began :

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<sup>16</sup>Both featuring an all-star ensemble of various writers, computer scientists, transhumanist experts, futurists, media philosophers, and such.

*... immediately saw the connections between the film and Descartes's speculations on the possibility of deception by dreams or an evil deceiver.*

This introduction even asked : "Is this a Christian film?" .

While the second had for full title 'Science, Philosophy and Religion'...

And, yet Pascal was nowhere to be found :

Neither in one nor the other; Pascal who shared many of the same characteristics as Descartes (being a philosopher-mathematician<sup>17</sup>), had questioned infinity, discussed truth vs. false perceptions, and even thinking machines!

This absence is worth noting all the more as in books that otherwise were not lacking in, various, references.

Either imputable to the quality, 'caliber' of commentators; or the insufficiency even insignificance of Pascal.

(We leave this judgement to others.)

## **VI - Cousin's interpretation**

Because the philosopher Victor Cousin played such an important role in our current understanding of Pascal, having produced the first scientific edition of the *Pensees*, (or what this author considers to be so), here his assessment of the differentiated legacies of Pascal :

*Descartes, who constantly invents and creates, sometimes makes errors. Pascal does not possess the same unbounded creativity ; however what does come out of him is always exquisite and complete ["acheve"]. Let us be honest : in Pascal, the Man is profoundly original, but the creative mind had not been given to him. In mathematics,*

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<sup>17</sup>"Or, Pascal et Descartes ce sont deux geometres et deux philosophes" as Cousin noted (report p. 4) ["Descartes and Pascal : ... two geometers and philosophers.]



*he has not made any of the sort of discoveries that change the face of science, such as the application of algebra to geometry : the only big mathematical computation [”calcul”] that remains associated with him is that probability; and this he shares at least on same standing with Fermat. In physics, he demonstrated the gravity of air which Descartes had found twelve years before even Toricelli. In philosophy he did little but reactivate the old battle of faith against reason. (...) [Pascal] has put nothing new into the world, but what he touched he brought to supreme perfection. (Report, p. 6)*

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1. Computers, and programming languages.
2. 'Philosopher-mathematician' before Bachelard (whose doctoral advisor was no other than Brunschvicg), Cavailles, and the others;
3. Origin point with Descartes of a long line of philosophers, and soon-to-be ex philosophers, who mixed philosophy with various scientific disciplines resulting in often stark results... E.g. sociology, linguistics...

These were some of the many sides of Pascal's legacy, in the various sciences, including the social sciences; and beyond.

If Lenin accused one of his opponents of "worming his way into debates, without opinion", the same cannot be said of our scholars.

And, yet in some cases we get strong indications that not always merely the noble search for truth may guide them.

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(Republished just in time for the "Streit")

Lenin, V.. *State and revolution*.

[It was here I believe that Lenin also noted how after the death of Marx, flipping German scholars suddenly rediscovered their dear 'national' Karl...]

## Pascal (the programming language)

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(This edition uses Pascal, later ones its successors.)
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(The first volume is of lesser interest, contains ALGOL 60 discussions.)

gleterre 870000, & dans les villages & hameaux 410000. Il estime la rente annuelle des terres à 10 millions sterlin; celle des maisons & des bâtimens à deux millions par an; le produit de toutes sortes de grains, dans une année passablement abondante, à 9075000 liv. st. la rente annuelle des terres en blé, à 2 millions, & leur produit net au-dessus de 9 millions sterlin; la rente des pâturages, des prairies, des bois, des forêts, des dunes, &c. à 7 millions sterlin; le produit annuel des bestiaux en beurre, fromage & lait, peut monter, selon lui, à environ 2  $\frac{1}{2}$  millions sterlin. Il estime la valeur de la laine tondue annuellement à environ 2 millions sterlin: celle des chevaux qu'on élève tous les ans à environ 250000 liv. sterlin; la consommation annuelle de viande pour nourriture, à environ 3350000 liv. sterlin: celle du suif & des cuirs environ 600000 livres sterlin: celle du foin pour la nourriture annuelle des chevaux, environ 1300000 livres sterlin, & pour celle des autres bestiaux, un million sterlin: le bois de bâtiment coupé annuellement, 500000 liv. sterl. Le bois à brûler, &c. environ 500000 liv. sterl. Si toutes les terres d'Angleterre étoient également distribuées parmi tous les habitans, chacun auroit pour sa part environ 7  $\frac{1}{4}$  arpens. La valeur du froment, du seigle, & de l'orge nécessaire pour la subsistance de l'Angleterre, se monte au moins à 6 millions sterl. par an. La valeur des manufactures de laine travaillées en Angleterre, est d'environ 8 millions par an; & toutes les marchandises de laine qui sortent annuellement de l'Angleterre, passent la valeur de 2 millions sterl. Le revenu annuel de l'Angleterre, sur quoi tous les habitans se nourrissent & s'entretiennent, & payent tous les impôts & taxes, se monte, selon lui, à environ 43 millions: celui de la France à 81 millions, & celui de la Hollande à 18250000 livres sterlin.

Le major Grant, dans ses observations sur les *listes mortuaires*, compte qu'il y a en Angleterre 39000 milles carrés de terre: qu'il y a en Angleterre & dans la principauté de Galles, 4600000 ames: que les habitans de la ville de Londres sont à peu près au nombre de 640000; c'est-à-dire, la quatorzième partie de tous les habitans de l'Angleterre: qu'il y a en Angleterre & dans le pays de Galles, environ 10000 paroisses: qu'il y a 25 millions d'arpens de terre en Angleterre & dans le pays de Galles, c'est-à-dire, environ 4 arpens pour chaque habitant: que de 100 enfans qui naissent, il n'y en a que 64 qui atteignent l'âge de 6 ans; que dans 100, il n'en reste que 40 en vie au bout de 16 ans; que dans 100, il n'y en a que 25 qui passent l'âge de 26 ans; que 16 qui vivent 36 ans accomplis, & 10 seulement dans 100 vivent jusqu'à la fin de leur 46<sup>e</sup> année; & dans le même nombre, qu'il n'y en a que 6 qui aillent à 56 ans accomplis; que 3 dans 100 qui atteignent la fin de 66 ans; & que dans 100, il n'y en a qu'un qui soit en vie au bout de 76 ans: & que les habitans de la ville de Londres sont changés deux fois dans le cours d'environ 64 ans. Voyez *VIE*, &c. MM. de Moivre, Bernoulli, de Montmort, & de Parcieux, se sont exercés sur des sujets relatifs à l'*Arithmétique politique*: on peut consulter la *doctrine des hasards*, de M. de Moivre; l'*art de conjecturer*, de M. Bernoulli; l'*analyse des jeux de hasard*, de M. de Montmort; l'*ouvrage sur les rentes viagères & les tontines*, &c. de M. de Parcieux; & quelques mémoires de M. Halley, répandus dans les *Transactions philosophiques*, avec les articles de notre Dictionnaire, *HASARD*, *JEU*, *PROBABILITÉ*, *COMBINAISON*, *ABSENT*, *VIE*, *MORT*, *NAISSANCE*, *ANNUITÉ*, *RENTE*, *TONTINE*, &c.

**ARITHMÉTIQUE**, pris adjectivement, se dit de tout ce qui a rapport aux nombres, ou à la science des nombres, ou qui s'exécute par le moyen des nombres. On dit opération *arithmétique*, de toute opération sur les nombres.

MOYEN <i>arithmétique</i> .	} Voy.	MOYEN.
PROGRESSION <i>arithmétique</i> .		PROGRESSION.
PROPORTION <i>arithmétique</i> .		PROPORTION.
RAPPORT <i>arithmétique</i> .		RAPPORT.

TRIANGLE *arithmétique*. Voyez TRIANGLE.

**ECHELLES ARITHMÉTIQUES**, est le nom que donne M. de Buffon (*Mém. Acad. 1741.*) aux différentes progressions de nombres, suivant lesquelles l'*Arithmétique* auroit pu être formée. Pour entendre ceci, il faut observer que notre *Arithmétique* ordinaire s'exécute par le moyen de dix chiffres, & qu'elle a par conséquent pour base la progression *arithmétique* décuple ou dénaire, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, Voyez *PROGRESSION*, &c. Il est vraisemblable, comme nous l'avons remarqué plus haut, que cette progression doit son origine au nombre des doigts des deux mains, par lesquels on a dû naturellement commencer à compter: mais il est visible aussi que cette progression en elle-même est arbitraire, & qu'au lieu de prendre dix caractères pour exprimer tous les nombres possibles, on auroit pu en prendre moins ou plus de dix. Supposons, par exemple, qu'on en eût pris cinq seulement, 0, 1, 2, 3, 4, en ce cas tout nombre passé cinq, auroit eu plus d'un chiffre, & cinq auroit été exprimé par 10; car 1 dans la seconde place, qui dans la progression ordinaire, vaut dix fois plus qu'à la première place, ne vaudroit dans la progression quintuple, que cinq fois plus. De même 11 auroit représenté 6; 25 auroit été représenté par 100, & tout nombre au-dessus de 25, auroit eu trois chiffres ou davantage. Au contraire si on prenoit vingt chiffres ou caractères pour représenter les nombres, tout nombre au-dessous de 20, n'auroit qu'un chiffre; tout nombre au-dessous de 400, n'en auroit que deux, &c.

La progression la plus courte dont on puisse se servir pour exprimer les nombres, est celle qui est composée de deux chiffres seulement 0, 1, & c'est ce que M. Leibnitz a nommé *Arithmétique binaire*. Voyez *BINAIRE*. Cette *Arithmétique* auroit l'inconvénient d'employer un trop grand nombre de chiffres pour exprimer des nombres assez petits, & il est évident que cet inconvénient aura d'autant plus lieu, que la progression qui servira de base à l'*Arithmétique*, aura moins de chiffres. D'un autre côté si on employoit un trop grand nombre de chiffres pour l'*Arithmétique*, par exemple, vingt ou trente chiffres au lieu de dix, les opérations sur les nombres deviendroient trop difficiles; je n'en veux pour exemple que l'addition. Il y a donc un milieu à garder ici; & la progression décuple, outre son origine qui est assez naturelle, paroît tenir ce milieu: cependant il ne faut pas croire que l'inconvénient fût fort grand, si on avoit pris neuf ou douze chiffres au lieu de dix. Voyez *CHIFFRE & NOMBRE*.

M. de Buffon, dans le Mémoire que nous avons cité, donne une méthode fort simple & fort abrégée pour trouver tout d'un coup la manière d'écrire un nombre donné dans une échelle *arithmétique* quelconque, c'est-à-dire en supposant qu'on se serve d'un nombre quelconque de chiffres pour exprimer les nombres. Voyez *BINAIRE*. (O)

\***ARITHMÉTIQUE (machine)**, c'est un assemblage ou système de roues & d'autres pièces, à l'aide desquelles des chiffres ou imprimés ou gravés se meuvent, & exécutent dans leur mouvement les principales règles de l'*Arithmétique*.

La première *machine arithmétique* qui ait paru, est de Blaise Pascal, né à Clermont en Auvergne le 19 Juin 1623; il l'inventa à l'âge de dix-neuf ans. On en a fait quelques autres depuis qui, au jugement même de MM. de l'Académie des Sciences, paroissent avoir sur celle de Pascal des avantages dans la pratique: mais

Figure 1: The Matrix



”Spirit has a natural tendency towards believing, and will loves naturally; such that, being deprived of real objects, they attach themselves to false ones.”  
(Pascal, *Pensees* 81 B)