

The Sacred and the Profane

An Analysis of Euler's Religious Life,
Including A New Translation from His Notes

John S. D. Glaus

It has been written that both the 17th and 19th centuries were more inventive in the production of scientific discoveries than the 18th century. There were great names in both centuries: Galileo Galilei (1564-1642) in the former and Karl Friedrich Gauss (1777-1855) in the latter. To mention what science was treated by which scientist is not a matter of conjecture, but it is also not a matter for this article. If there is anything for which the 18th century is best known one might be tempted to say that it was Aufklärung, or Age of Reason; but there was little reasonableness. It was during the 18th century that the sciences began to assume their modern meaning. There was an elusive and ethereal connection between metaphysics and physics; between science coming of age, the quest for the philosopher's stone and the statutes of empirical experimentation over old wives' tales. The last vestiges of the 18th century are an attempt, at least in the sciences, including both experimental and natural philosophies, to

make better connections between the new Physics and the modernization of Metaphysics.

It is difficult to miss the imprimatur of Leonhard Euler in the 18th century; suffice it to say that he was at the epicenter of scientific thought of the half-century 1730-1783. The full conspicuousness of his genius began early in life and ended the moment of his death. However to understand Euler's religiosity, one must necessarily tread back a little to understand the denomination where Paul Euler—Leonhard's father—became rooted. In the 17th century, the Lutherans continued to evolve and from them came a denomination called the Pietists, who practiced a very pragmatic and useful devotion, full of practical incentives and rewards helpful and useful in raising children, universal in its approach to helping the destitute and the orphaned. In Leonhard Euler's estimation Pietism contained an enlightened feature for teaching Scripture. The pious works of the Protestants had evolved into the necessity of a lively faith and the "sanctification of daily life." The first significant Lutheran of the mid-17th century was Philipp Jakob Spener (1635-1705) who having "recognized the impossibility of leading the people to the desired degree of perfection" created the *Collegia pietatis* in 1670, which began as a private congregation that gathered at his house for scriptural readings and fellowship. One of the six features which were introduced as a reform to the current Lutheran practices was to live a "practical" Christianity. But after Spener was appointed to the court in Dresden, his followers established a *Collegia philobiblica* in Leipzig and the Pietist movement came under increasing scrutiny from the theological faculty. Spener was called to Berlin, where he enjoyed the protection of Prince Frederick III (1657-1713) who wielded a decisive influence in the selection of professors for the theological faculty of the recently founded University of Halle and so became the center of the Pietist movement in Lutheran Germany.

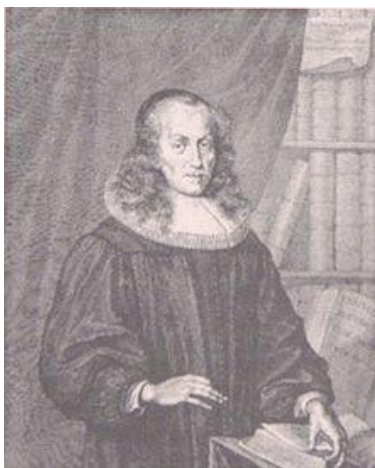
This is the brief account of what leads us from this very chromatically infused begin-

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The 10th annual meeting of the Euler Society was held at Carthage College in Kenosha, Wisconsin, July 25-27, 2011.

Front (L to R): Joy Rickey, Jim Harper, Paul Bialek, Dominic Klyve, Erik Tou. Back (L to R): Bruce O'Neill, Michael Saclolo, Robert Bradley, Al Klingenberg, Sandro Caparrini, Stacy Langton, Fred Rickey, Benjamin Collins, Tim Eckert, Tom Drucker, Justin Schroeder, Temple Burling, Justin Brockmann, Brian Schwartz, Emil Sargsyan, Emma Sorrell, Mark Snavely, Chukwugozie Maduka, Richard LaHue, Phil Woodruff.



L to R: Lutheran theologian and Pietist reformer Philipp Jakob Spener (1635-1705), Lutheran Pietist professor August Hermann Francke (1663-1727), and Frederick I of Prussia (1657-1713) [formerly Prince Frederick III]

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ing of the Pietist movement within Lutheranism to the end of the 17th century when August Hermann Francke (1663-1727) became a professor and pastor in Glaucha near Halle in 1692. Francke is important since it is he who established the orphan asylum that is referenced in Euler's own notes. On the whole, the Pietists were doctrinaire Lutherans preserving the content of Lutheran dogma but not the way in which it was to be delivered. The great schism that marked the Pietists was the renunciation of the Lutheran belief of justification by faith alone. The Pietists insisted on a life of "active devotion, the doctrine of repentance, conversion and regeneration"; these dogmatic institutions were called the Pietist conventicles and lead to regeneration through prayer, devout readings and exhortations. Even though Halle campaigned against the Pietists, and though it experienced a period of decline after the deaths of its founders Spener (1705), Francke (1727) and Joachim Justus Breithaupt (1732), the influence had already spread.

King Frederick I and Frederick William I stipulated that all theologians who desired appointments in Prussia had to study at Halle for two years. However, Frederick William's successor Frederick II did not show any particular favor to them, though he did have a special affection for the Huguenot community in Prussia. In his old age he said that he was happy to have lived long enough to celebrate the Jubilee of the Revocation of the Edict of Nantes in 1785. Perhaps he wished to re-connect the religious colony with the skeptic colony, the Calvinist refugees with the philosophical redoubt, in which Pierre-Louis Moreau de Maupertuis (1698-1759), Jean Baptiste d'Argens (1701-1771), Jean le Rond d'Alembert (1717-1783), Julien Offrey de la Mettrie (1709-1751) and François Marie Arouet alias Voltaire (1694-1778) had their own brilliance. If however, Frederick II had conceived of such hope, he would have had to renounce it fairly quickly. The Protestant refugees would never have allowed themselves to be mistaken for freethinkers. So it was for the Pietists.

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The Euler Line

The Old and the New



Three years ago, **Suijun Jia** and **Ruifang Ren** published a paper, "The development of Euler's contribution to the concept of function" [in Chinese] in the *Journal of Northwest University, Natural Sciences Edition* **38** (3) (2008), pp. 513-516. The authors conclude that Euler's perception of a function as an analytical expression was crucial to the transformation of the idea of function from a geometrical to an algebraic concept.

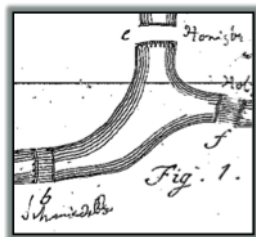
A. M. Zubkov's paper, "Euler and combinatorial analysis" [in Russian] appeared two years ago in *Istoriko-Matematicheskie Issledovaniya* (2) **13** (48) (2009), pp. 38-48. The author surveys Euler's work in graph theory, Latin squares and pentagonal numbers. A review by **Radoslav M. Dimitric** is available at Zentralblatt MATH 1202.01059.

Detlef Spalt's paper, "Welche Funktionsbegriffe gab Leonhard Euler?" [in German], appears this month in *Historia Mathematica* **38** (2011) pp. 485-505. From the [abstract](#): Leonhard Euler's notion of function as an "analytical expression," occasionally denoted by $f(x)$, is well known. But it has gone unnoticed that Euler used a second well-defined notion of function for which he even coined a particular denotation: $f :$, used as $f : x$. In fact, this second notion of function is the earlier one, defined as "the ordinate which depends on the abscissa," given by the curve. Euler argues that this "geometric" notion of function is more general than the "algebraic" one. Consequently, Euler relies on this more general notion of function when he integrates functions of several variables.

The **Euler Archive** made an appearance in the [Chronicle of Higher Education](#), as John Bukowski's pick for the Chronicle's article on favorite online resources. Other resources that made the cut were *Imaging the Iliad* (an iPad app that combines text and images from the Iliad) and the [Apple Examiner](#) (a web site devoted to the tracking of ongoing upgrades and developments for Apple products).

On the Euler Circuit

Recent meetings and colloquia on Euler



Dominic Klyve gave two talks on Euler in April 2011:

"Clairaut, Euler, and Newton: the gravity crisis of the 1740's," at the Central Washington University Physics Colloquium, April 11.

"The Life, Legacy, and Lost Library Books of Leonhard Euler," Department of Mathematics, Whitman College, April 14.

Shippensburg University of Shippensburg, Pennsylvania, is using Leonhard Euler as the theme for their department colloquium series this year. More information is at

www.ship.edu/Math/Current_Semester

The Steller Society Commemorates Euler

Georg Wilhelm Steller (1709-1746) was a member of the Imperial Russian Academy of Sciences in St. Petersburg who accompanied Vitus Bering at the Kamchatka Expedition and discovered the sea cow (which bears his name) in the Bering Sea in 1745. The Annual Meeting of the Steller Society in Halle, October 13-15 of this year, was partly devoted Euler.

Ruediger Thiele spoke on "Euler and Pallas." Peter Simon Pallas (1741-1811) was professor of natural history at the St. Petersburg Academy. He joined scientific expeditions to Siberia (1768-1774) and Russia and is also known for iron meteorites (pallasites) and a long-haired cat (Pallas' cat).

Another lecture was delivered by **Michel Kowalewicz**, University of Cracow, Poland. Kowalewicz, who is a professor of philosophy, commemorated the 100th anniversary of Euler's Opera Omnia. His talk was based mostly on unknown Russian archive material, which showed that it is not true that in the first years of the edition the Opera Omnia was primarily supported by the Swiss Euler Commission, but rather that the crucial support came from the Imperial Russian Academy, which had a strong interest in such an edition since the days of P. H. Fuss.

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Perhaps the conclusion of this introduction should be from Euler himself, and there is no better document that reveals his self-determination than that of his "Defense of the Divine Revelation against the Objections of the Freethinkers" [E92, 1747]:

A reasonable creature cannot be happier, according to the measure of knowledge which has been apportioned to it, than when it has perfectly conformed its will to do the duties known to it and has fully assuaged all the desires which run contrary to them, so that there are no inclinations left, except those which conform to these duties. For whoever has put himself in such a state will enjoy true peace of mind and nothing can trouble his contentment. This contentment cannot be increased any further later on, unless the mind reaches a more perfect knowledge and at the same time the will is improved according to this same knowledge and becomes more and more submissive to the will of God.

— J. S. D. Glaus

PS. My grateful appreciation goes to Rüdiger Thiele and Karin Reich for their determination and assistance in assisting me from cobbled notes to a properly researched document.

Excerpts From the Notes of Leonhard Euler

Those of the venerated company of the Consistory have named me to a commission which has as its purpose to place the catechism onto a better footing. However, I do not think that I will find a better way to do so except by proposing the ways of my late father who used this method to provide more instruction and interest to this part of our religious service. He did so well that the example of his success was used in a few other churches. The catechisms were better attended than previously and the entire congregation has judged that they have found it as a better education than ordinary sermons.

My father separated the youth into certain classes according to their gender and their capacity. Every Sunday afternoon, each of these classes met one after another and presented themselves to church and answered the questions that he asked them from certain sections of their catechism. Firstly, everyone recited the responses from the catechism word for word in an intelligible way and then my father explained the subject in greater detail and addressed them on the matter and added new questions, choosing one child and then another, without observing any type of order and they had to answer from their own knowledge. In order to achieve this he prepared them during the week having assembled them together twice at which they had to appear the following Sunday. In this way the children were able to fully answer the additional questions which he asked of them; and if one of them was not able to answer, he asked someone else which produced a very strong emulative effect and the occasions presented themselves in large numbers to all those present and the opportunities to address all present with questions and answers, to everyone's benefit even if they had not studied.

However what made these exercises even more interesting and which placed my father in a better position to usefully occupy the children and to have all of those present pay attention, was the very helpful use of a book of stories based on the Bible that the late Mr. Hubner had published under the title "Fifty-two stories taken from the Old and New Testaments" which contained questions,

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moral quotations and thoughts which were relative. My father had a new edition made so that every child could obtain it at a very reasonable price. Every time that such a story was dealt with in the catechism which the children promptly answered to the attached questions, they continued on with the moral quotations and to the salutary reflections. The latter of these were conceived of in verse so that the children had to learn them by heart which provided new topics to support the entire group.

Hubner's work that was mentioned is undoubtedly well-known and it can always be used as a model to compose such a work in French which what I should hope will become even more perfect for the goal for which it is being offered. But it contains some shortcomings and it should be hoped that one of our ministers will undertake this task.

We can easily admit that in this way by always joining a story from the Bible to our catechisms we will become much more instructive and interesting not only for the children but for all the members of the church. I can even assure you that because of the success that my father had these lessons will be better attended and a greater number of the public will come to the ordinary sermons. Perhaps it would be no more difficult to substitute them in the place of the sermons in the afternoon to the great relief of the Pastor. It would be expected that none of the special children wanted to have him drop this exercise and to this effect it is important to be careful in the distribution of these classes. If for example the chapel of the Fridrichofstatt was made available for catechism to the children from the orphanage and the charity school to which we can add the other poor children from the Colony we might be able to provide Werder with similar teaching to the children who are better off in such a way that no one would be upset. An exercise where children would become accustomed to speaking in public would also be very useful in other ways besides the wonderful information that they would receive on that occasion.

I would not want that the minister to be in the pulpit during these teachings. He can fulfill these duties much more conveniently being on the floor in the middle of the children that are assembled each time; as important as it is to be in their midst as it is to be close to them to respond to their questions.

It would also be good to have a Bible placed on a desk so that the children might be able to look up the passages which are part of the catechism and to make them read out loud which will help them to become familiar with the Holy Scripture and will maintain everyone's attention.

Such an arrangement in the beginning might very well encounter some difficulties, but once it is underway, may I dare to hope that everyone will look on it as one of the most important accomplishments of our Church.



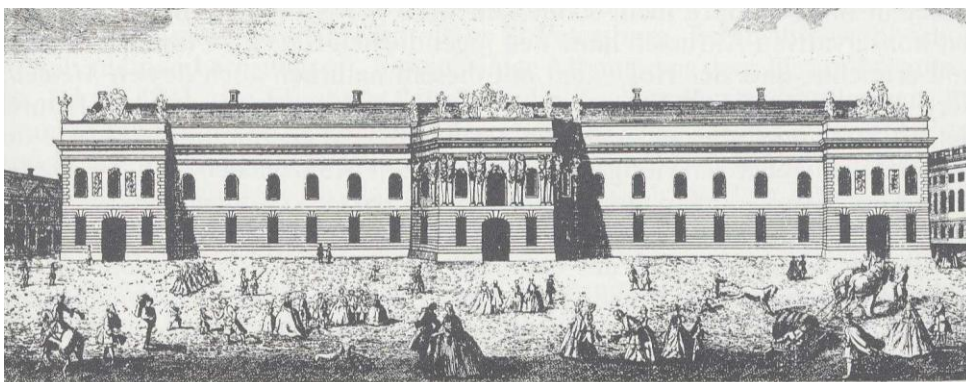
This house in Magedeburg, Germany (formerly Prussia), is the one in which Princess Charlotte Frederick lived during the Seven Years' War (1756-1763); she was the princess to whom Euler wrote his famous *Lettres à une Princesse d'Allemagne*.

Image courtesy of Ruediger Thiele

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Leonhard Euler 1707-1783, Mathematiker – Mechaniker –
Physiker Braunschweigisches Landesmuseum © 2008



Prospect der vor einigen Jahren abgebrannten, und nunmehr ganz neu aufgeführten Hofstallgebäude des großen Königs Stalls, auf der Dorotheen-Strasse zu Berlin, welches überaus ansehnliche Gebäude für die Königl. Academie der Wissenschaften und freien Künste, und für die Academie der Kunst- und mechanischen Anstaltswissenschaften bestimmt ist.

An 18th Century Illustration of the Berlin Academy. Translation of the German description: *View of the building of the large Royal Stable in the Dorotheen Quarter of Berlin which is now completely new, erected after it burnt down a few years ago. This very handsome building is for the Royal Academie of Sciences and Belles Lettres as well as for the Academy of Arts.*

Image and translation courtesy of Ruediger Thiele

Opusculum is the official newsletter of the Euler Society. It is published on a quarterly basis.

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Letters, articles, and other contributions to the *Opusculum* are very welcome. Send any contributions, observations, or news items to Erik Tou at etou@carthage.edu.

The mission of The Euler Society is three-fold: It encourages scholarly contributions examining the life, research, and influence of Euler. The Society also explores current studies in the mathematical sciences that build upon his thought. And it promotes English translations of selections from his writings, including correspondence and notebooks.

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Translation and Archive Update

Michael Saclolo of St. Edward's University in Austin, Texas has completed his translation of "Recherches physiques sur la nature des moindres parties de la matiere" ("Physical investigations on the nature of the smallest parts of matter") [E91]. This paper... It is currently available on the [Euler Archive](#).

Jasen Scaramazza of Rowan University has completed an English translation of "Recherches sur quelques integrations remarquables dans l'analyse des fonctions a deux variables connues sous le nom de differences partielles" ("Research into some remarkable integrations in the analysis of functions of two variables known as partial differential equations") [E724].

Some high-quality scans of Euler's *Vollständige Anleitung zur Algebra* [E387-388] are available through the University of Köln:

http://www.uni-koeln.de/math-nat-fak/didaktiken/mathe/volkert/Euler_ueber_negative_Zahlen.pdf

http://www.uni-koeln.de/math-nat-fak/didaktiken/mathe/volkert/Euler_ueber_figurierte_Zahlen.pdf

Two samples are shown below:

Kapitel 2.
Erklärung der Zeichen + plus und - minus.
8. Wenn zu einer Zahl eine andere hinzugefügt oder addirt werden soll, so wird dies durch das Zeichen + angedeutet, welches der Zahl vorgesetzt und plus ausgesprochen wird.
Also wird durch $5 + 3$ angedeutet, daß zu der Zahl 5 noch 3 addirt werden sollen, da man dann weiß, daß 8 heraus kommt. Eben so z. B. $12 + 7$ ist 19; $25 + 16$ ist 41 und $25 + 41$ ist 66 etc.
9. Durch dieses Zeichen + plus pflegen auch mehrere Zahlen verbunden zu werden, wie z. B. $7 + 5 + 9$, wodurch angegeben wird, daß zu der Zahl 7 noch 5, und außerdem noch 9 addirt werden sollen, was 21 ausmacht. Hieraus ersieht man, was nachstehende Formel bedeutet:
 $8 + 5 + 13 + 11 + 1 + 3 + 10$,
nämlich die Summe aller dieser Zahlen, welche 51 beträgt.

Anleitung zur Algebra. 169
durch Punkte darstellen lassen. Dieselben schreiben demnach folgendermaßen fort.
Zeiger 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
Arith. Reihe 1, 4, 7, 10, 13, 16, 19, 22, 25, 28, 31
Fünffach 1, 5, 12, 22, 35, 51, 70, 92, 117, 145, 176
u. s. w., und der Zeiger giebt die Seite jedes Fünffachs an.
433. Wenn also die Seite n gesetzt wird, so ist nach der in 423 angegebenen Formel die fünffache Zahl $= \frac{n^2 - n}{2} = \frac{n(n-1)}{2}$. Wenn z. B. $n = 7$, so ist das Fünffach 70. Will man die fünffache Zahl von der Seite 100 wissen, so setzt man $n = 100$ und bekommt 14950.
434. Setzt man die Differenz = 4, so erhält man auf diese Art die sechsfachen Zahlen, welche also fortgeschrieben.
Zeiger 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.
Arith. Reihe 1, 5, 9, 13, 17, 21, 25, 29, 33, 37.
Sechsfach 1, 6, 15, 24, 33, 42, 51, 60, 69, 78, 87.
Der Zeiger giebt wiederum die Seite jedes Sechsfachs an.

The title image for this issue of *Opusculum* is a portion of the Baltic seacoast taken from the 1760 edition of the *Atlas Geographicus*, the compilation of which was supervised by Leonhard Euler. It is numbered as E205 in Eneström's Index, and is available on the [Euler Archive](#).