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Wojciech Jastrzębowski

AN OUTLINE OF
ERGONOMICS,

Or

THE SCIENCE OF WORK
based upon the truths drawn
from the Science of Nature

1857

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Commemorative Edition
Published on the Occasion
of the XIVth Triennial Congress of the International Ergonomics Association and
44th Annual Meeting of the Human Factors and Ergonomics Society
San Diego, California, USA

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International Ergonomics Association



Human Factors and Ergonomics Society



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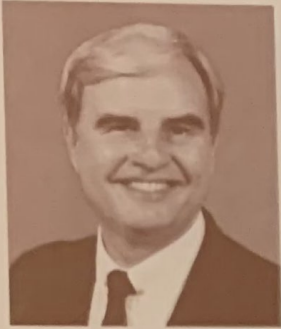
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Central Institute for Labour Protection
Warsaw, Poland
2000



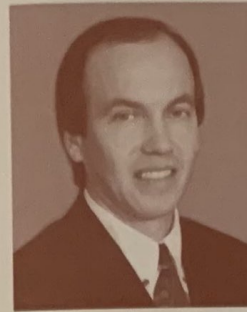
On behalf of the Congress Organizers, it is a great pleasure to present you with this 2000 Congress Commemorative Edition of Wojciech Jastrzębowski's classic 1857 treatise, "An Outline of Ergonomics, Or the Science of Work based upon the truths drawn from Science and Nature." It seems only fitting that, as we celebrate "ergonomics for the new millennium," we also take note of this very first known publication on the concept of "ergonomics" and, indeed, of the coining of the term itself. In this treatise, Jastrzębowski notes that ergonomics deals with "useful work," which brings improvement or is commendable, and involves making good use of "Man's forces and faculties." He contrasts this with "harmful work" that brings deterioration. These initial conceptualizations of ergonomics ring true even today.

Jastrzębowski was a brilliant visionary who was well ahead of his time. Not only did he envision ergonomics or a science of work, but also described a proposal for creating a League of Nations. Philosopher, inventor, teacher and researcher, he possessed the talents and interests normally ascribed to a true "Renaissance Man."

We are deeply indebted to the Polish Ergonomics Society and the Central Institute for Labour Protection for agreeing to publish this special Commemorative Edition on behalf of the XIVth Triennial Congress of the International Ergonomics Association and 44th Annual Meeting of the Human Factors and Ergonomics Society.

Prof. Hal W. Hendrick

Congress Chair



We take great pleasure in presenting Wojciech Jastrzębowski's treatise "An Outline of Ergonomics, Or the Science of Work based upon the truths drawn from the Science of Nature." Wojciech Jastrzębowski, a Polish scholar, philosopher and naturalist, was the first in the world to use and define the concept of ergonomics. The year was 1857.

"By the term Ergonomics, derived from Greek *ergon* – work, and *nomos* – principle or law, we mean the Science of Work, that is the use of Man's forces and faculties with which he has been endowed by his Maker."

Sadly, the fortunes of this scholar were as dramatic and complicated as dramatic and complicated were the fortunes of 19th century Poland, then partitioned among Russia, Prussia and Austria. Times were not conducive to the peace of mind that is vital for completing works that can be disseminated in the free world.

Almost a century and a half after Wojciech Jastrzębowski's treatise was first published, we wish to share with you the thoughts of this forgotten scholar.

The XIVth Triennial Congress of the International Ergonomics Association and 44th Annual Meeting of the Human Factors and Ergonomics Society (San Diego, CA, July 30 – August 4, 2000) usher us into the new millennium. It is most fitting then to devote some time to studying the work of the philosopher who defined the concept of ergonomics in the past millennium.

Prof. Waldemar Karwowski

Secretary General
International Ergonomics Association

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Director
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**Wojciech
Jastrzębowski**

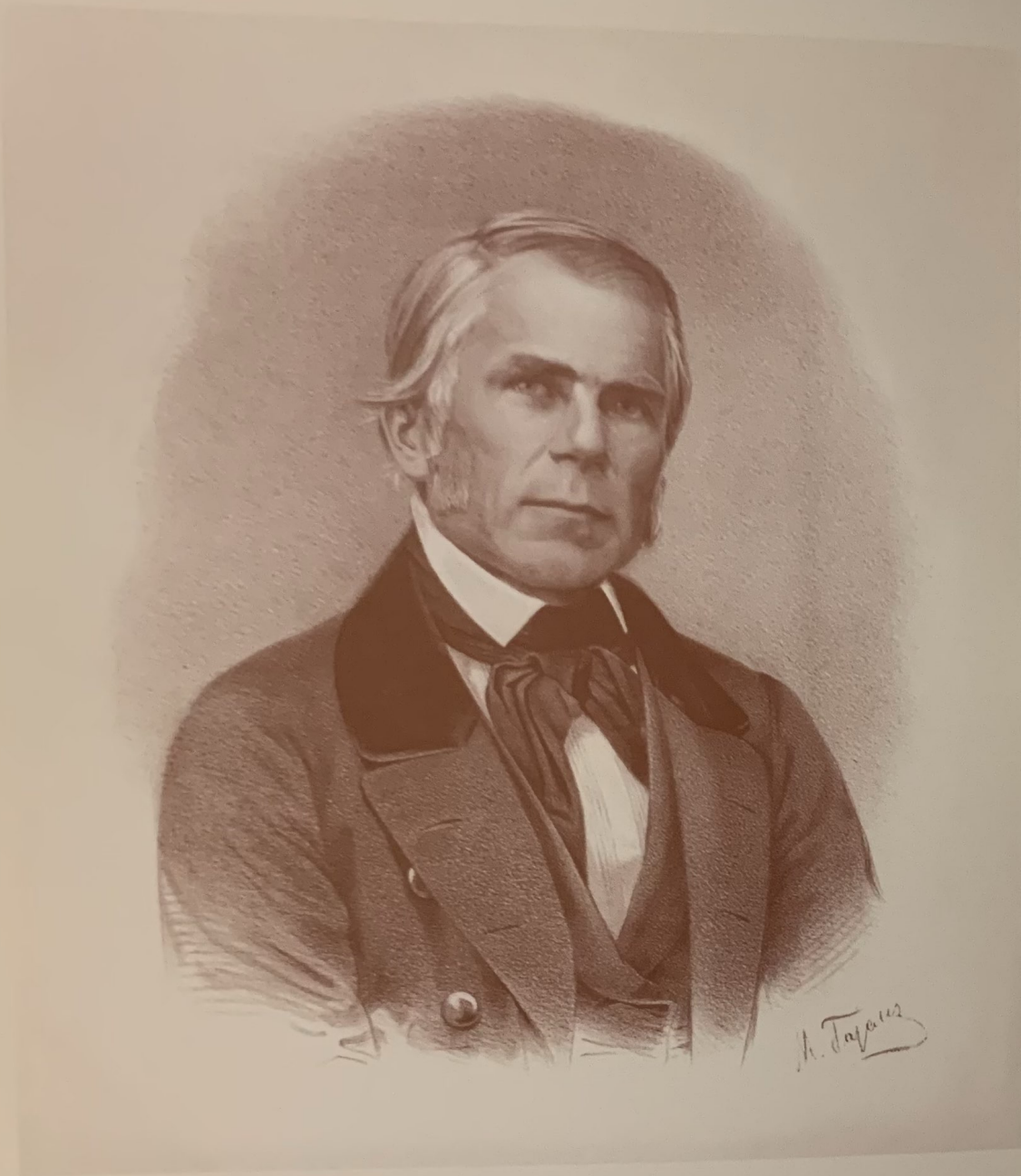
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Wojciech Jastrzębowski

Wojciech Jastrzębowski's portrait taken from Maxymilian Fajans's *Wizerunki polskie* (Polish Portraits) published by the author in Warsaw in 1851

Wojciech Bogumił Jastrzębowski (1799–1882)

In the treatise entitled “Rys ergonomji czyli nauki o pracy” (An Outline of Ergonomics, Or the Science of Work based upon the truths drawn from the Science of Nature), published in *Przyroda i Przemysł*, Poznań, Poland (1857), W. B. Jastrzębowski created the foundations of ergonomics.

Wojciech Bogumił Jastrzębowski, inventor, scientist, educator and naturalist, was born to an impoverished noble family on April 14, 1799, in Giewarty, a village in the north of Poland. He was orphaned at a young age. In 1816, he went to high school in Plock. Due to poverty and ill health his education was often interrupted. In December 1820, Jastrzębowski enrolled in the Faculty of Engineering and Surveying of the University of Warsaw. His knowledge, enthusiasm and ingenuity made his professors assign him several supporting research projects. In September 1822, he also began studying at the Faculty of Philosophy (Natural History). During his studies he assisted in the research of several biologists, astronomers and zoologists.

At that time he was commissioned to set up a sun dial in the Warsaw Łazienki Park (the sun dial is now famous). As setting up a sun dial required individual measurements for each location, he designed a special piece of equipment “for determining compasses in any space and in every location.” The Government Commission called it “Jastrzębowski’s Compass,” and the inventor was admitted to a Warsaw scientific society.

When the Polish November Uprising against the Russian invaders broke out in 1830, Jastrzębowski volunteered and fought at the Battle of Olszynka Grochowska. At that time he also developed a proposal to create a League of Nations, which opened with the words, “Peace in Europe is permanent and everlasting.” According to this proposal, a European Congress should publish a proclamation calling upon all the nations to form a brotherly alliance. All disputes between states would be defused by a commonwealth of nations, whose decisions would be objective and just. When there was no more unhealthy armaments rivalry between friendly nations, all their effort should be directed towards improving the education of the youth, laws, science, agriculture and industry.

After the fall of the November Uprising, Jastrzębowski could not go back to his job at the University of Warsaw. In 1836,

he became professor of botany, physics, zoology, mineralogy and horticulture at an institute of agriculture and forestry at Marymont, near Warsaw. Thanks to him, the Marymont gardens became a protected area of rare shrubs and trees. Jastrzębowski’s students were taught to be methodical and consistent, restrained and patient in the laborious task of fact collecting. At the same time, however, he cautioned them not to become simple archivists of facts; they were to try to unravel the mystery of creation. Jastrzębowski devoted a lot of time to field trips with his students across all regions of Poland. Those expeditions resulted in a study on forecasting fair weather, sleet, wind and other changes of the air (1847), which was also translated into Russian. Thanks to the study, Jastrzębowski was admitted to several Polish scientific societies.

In addition to the historic treatise “An Outline of Ergonomics, Or the Science of Work based upon the truths drawn from the Science of Nature” (1857), Jastrzębowski published several books and papers on Ananconomics, or the science of needs (1846), natural history applied to the needs of practical life (1854), Stichiology, or the science of the beginning of the universe (1856), mineralogy (1851), and Bionomy, or the science of life (1858). Upon leaving the Institute in Marymont Jastrzębowski was given the post of works inspector for the preservation and afforestation of the dunes of Czerwony Bór. He settled in Feliksówka, where he established model gardens, nature rooms, and a residence for trainees. During the next Uprising, January 1863, the residence emptied. His students and his two sons joined the Uprising. During the fighting the buildings of Feliksówka went up in flames.

The *Florae Polonicae Prodrromus* – even today one of the basic textbooks of plant geography in Poland – was published by Józef Rostafiński in Vienna in 1872. In it, he describes 1550 plants, of which 1090 are labelled with Jastrzębowski’s name since their names had been taken from his herbarium. In 1874, Jastrzębowski left his study in Czerwony Bór and tried to recreate a garden with his favourite yews and larches on a small plot of land in the Warsaw suburb of Czyste. At the same time he was commissioned by the Warsaw–Vienna Railway to plant hedges round its stations and stops. The last time he went out to study Nature was in 1879. Wojciech Jastrzębowski died in his apartment in Warsaw, in ulica Kruca, on December 30, 1882. He was buried in the Powązki Cemetery in Warsaw.

Vignette of the weekly *Przyroda i Przemysł*
(Nature and Industry), No. 29, 1857, in which
the first part of Wojciech Jastrzębowski's article
"An Outline of Ergonomics, or the Science of Work"
(original title "Rys ergonomji czyli nauki o pracy")
was published.



A. L. W. D. B. E. R. M. A. N. N. S. A.

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Rok 2.

N^o. 29.

1857.

AN OUTLINE OF ERGONOMICS,

Or
THE SCIENCE OF WORK

based upon the truths drawn from the Science of Nature

by
Wojciech Jastrzębowski
a word is as good as a wink to the wise man

INTRODUCTION

Hail, Thou great unbounded idea of work! God, Who, as the Bible teaches us, cursed mankind and subjected him to work, cursed him with a father's heart; for the punishment was also a consolation. He who complains against his work knoweth not life; work is an uplifting force by which all things may be moved. Repose is death, and work is life!

If there were as many people preaching the idea of work in other words the idea of the deed as there are those who preach the idea of the word, the thought, the feeling, form, of Mysticism, Idealism, Materialism, Pantheism, Egoism and many other such things, what a great deal of good there would be happening in the world!

What would be the fate of two societies, of which one would be engaged in useful work and praiseworthy deeds, such as the tilling of the soil and the improvement of the people, while the other consisted of persons busy with words, thoughts, feelings, and other things of those just enumerated?

Affecta nihil aliud sunt, nisi accessoria ad facta.

Affections are nothing else, but accessories to deeds.
By their deeds shall ye know them.

Not every one that saith unto Me, Lord, Lord, shall enter into the kingdom of heaven, but he that doeth the will of My Father ... (Mat. 7:21)

Work enriches or *divitiates* us, making us more like unto the *Divine*...

Work is the mother of all good.

He who relies on others shall be forsaken by God.

God cannot save us without us.

Were God to come down from heaven and appoint the Archangels His Ministers and the Angels his servants, there shall still be no happiness in the world until mankind comes to

*) The friends of work will not hold it against the author, he trusts, that he is here repeating some of his main tenets already published elsewhere.

love work and until all people apply all of the forces given them by the Creator to work.

One idle man, in other words one squanderer of the forces and faculties with which Man is endowed by God, may do more evil in the world than a thousand industrious people can do in amends for him.

One bad man can do more damage than ten good men can help.

As the body of a particular man suffers and incurs loss from the ailment, idleness or malfunction of even one of his limbs, so too the body of society suffers and needs must incur detriment if even one part of it is in a similar condition.

What a thousand good men gain in a thousand years of work, one wicked man given to laziness may destroy in one day.*

Just as there may be no good wall without good bricks, and no good edifice without good walls, so without good people there may be no good peoples, and without good peoples mankind shall not be good.

Which people, and which of their labours is best — is it not that whereby the most: the most things, the greatest number of people, and they themselves — have been bettered?

The above-cited sentences, whatsoever source they may come from (which is of least import to the truth that through them is revealed, and to the good that may come to us and to all men from the acknowledgement of this truth as indisputable) have been placed at the head of this treatise on work, in other words on the good use of the forces and faculties given Man by his Maker, so that, knowing the need for such work on the strength not merely of our own but of the general conviction, and acknowledging it as an indispensable condition of our happiness and well-being in this world, we may endeavour to bring first our own will unto work, and then the wills of all those of our fellow-brothers whom we have the power to influence by word or example. By this inclining of ourselves and our fellow-men unto work we may contribute to the fulfilment of their and our own hopes for the improvement of their and our existence. Which improvement and increase both in the material as in the moral respect haveth its surest warranty only in the said work, *source of all good*.

That this be truly so, that it is only in work that the surest hope lies for the improvement and increase of our own and

*) As evidenced by the histories of Herostatus and Cleopatra.

the general well-being — in work which is useful and commendable, such as the tilling of the soil or the betterment of people and things — no man appears to doubt in the least, since it is only through such work that all things may be improved and rendered fit to serve the common good.

And apart from this our *forces* and abilities, whereby and through the guidance of which we perform our work, develop through our exercise of work, perfecting in the proper respect, and thereby contributing to the advancement and perfection of our entire being, which is the condition for our felicity and without which our existence is meagre and ever under the threat of doom. For it is well-known that our vital *forces* grow weak and impoverished as much by the *lack* of their exercise as by their *abuse*; and that they are maintained in their proper condition, growing and increasing by their proper and moderated exercise, which we call work, and whereby we improve things, people, and ourselves, making them and us more conducive to the service of the common good.

But lest that *exercise* of our *forces*, which is the principle and essence of our lives, be too burdensome upon us; that it may bring us to the source of felicity and contentment — we ought ever to arrange it in such a manner that it may not hamper those vital forces in us, but that it may extend to include all those forces we have in us and by which we may serve the said common good.

For it is only through such application of all our forces united that they may be mutual supports one unto another, not only making our work lighter but also bringing us greater profit, as we have seen elsewhere, for instance in the *application* of those forces to the enhancement of the earth's fertility. For if the earth's fertility be improved merely by the least of our vital forces, that is by the physical or *motory* force, the force of movement whereby we subsist only in sleep, in sleepwalking and in the mere unconscious carrying out of our ordinary chores, she shall prove but so little enhanced in her action and capacity to act that for each grain we entrust unto her she shall bring forth but *two* in harvest.*

But if we endeavour to raise the earth's fertility by applying both our physical and our aesthetic forces, that is our *motory* and our *sensory* or *emotional* forces, which will ensue when we cultivate the land industriously and with a sense of taste, the

*) See our treatise on the *vital forces* and their importance in Man's productive life.

earth's fertility will be doubled by the engagement of our effort so as to bring forth a *fourfold* crop at harvest for every grain sown.

This gives us grounds to suppose that if we were to apply three of our vital forces for the enhancement of the earth's fertility, our physical force, our aesthetic force, and our intellectual force, that is our forces of *motion*, of *feeling*, and of *reason*, then the earth's fertility would become even more efficient, such that for every grain sown the crop would be *eightfold* at harvest-time. This is generally confirmed by all our present-day well-managed farms, that is those that are managed industriously, and according to the precepts of taste and reason, with the use of the three above-mentioned forces. This leads us to the premise that if we could enlist yet a fourth of our forces, adding it to the other three, the earth's fertility could be raised to a still higher power.

And since the relation between the three former forces with respect to the increase of the earth's fertility is, as we believe, a *doubling effect of the previous outcome*, for as we have seen the ratio between them is 2: 4: 8, we may thus expect that this fourth force, the moral or *spiritual* force which induces us to work not only for our own and the common good (which entails the glory of God, the welfare of our neighbours, of our fellow creatures and of ourselves) could advance the earth's fertility so much as to yield twice eight, or *sixteen* grains at harvest from every grain sown.

This is not far from the truth, for we have observed through our own experiment, carried out in the strictest conditions, that given our appropriate application of all the four vital forces just mentioned to the earth's fertility, it may be brought to the state where for every grain sown, e.g. of wheat, the harvest from even modestly fertile soil not particularly suited for wheat will be threehundredfold. But such an occurrence is still not the highest on record, for elsewhere there have been experiments carried out which have shown that with the engagement of but three of man's vital forces, that is his *motory* force, his *emotional* or *sensory* force, and his *intellectual* force, the harvest obtained was over three times the just quoted value of a threehundredfold crop, that is about one thousand grains of crop from each grain sown — one hundred and twenty-five times eight, which marks the richest ordinary yield to be expected from the application of the three just mentioned forces, and 62½ times 16, that is the crop to be expected from the engagement of all four of our forces, and without their very great exertion.

What has been said here of the earth's fertility, that is of *its increase by the application of our vital forces to it*, holds for all the other forces of living and inanimate Nature. For even those forces, as for example steam power and electrical power, which previously in their natural condition were of so little effect, under the exercise of merely our *sensory* forces upon them, have now in our own times progressed so far in their marvellous and beneficial effects to a much higher importance by the application to them of the first three of the human forces. We shall now turn our attention to the forces of living Nature only, of which we say there are only as many as we have observed in our own being, that is four (viz. 1. the physical, kinetic or *motory* force of movement, such as is given to all living creatures, even the lowest of them, the Plants); 2. the aesthetic or *sensory* force which is possessed by all creatures capable of feeling, even the lowest of them, the invertebrates or *Primitive Animals*; 3. the intellectual forces of *reason* of which all comprehending and thinking creatures are endowed, even the lowliest of them such as the fishes, the reptiles, the birds, and the quadrupeds, in other words all *Animals*; and finally 4. the moral or *spiritual* force which has been ascribed only to human beings, that is to *Mankind* proper). If we now turn our attention to these forces of living Nature we shall see that they are even more conducive to give bigger and bigger yields as we exert our vital forces on them than are the forces of inanimate Nature, which make the things on which they act and in which they are lodged produce only inanimate returns, in other words only the utilities, for the common good. But the forces of living Nature can generate, through their development and perfecting brought about by our own forces acting on them, gains which are animate, that is the services, favours or goods, as demonstrated by properly conducted bee-keeping, by well-managed animal husbandry, and by a similarly well-ordered education and management of human resources. As a result of the appropriate education and suitable government of human beings, in other words through the furtherance and management of man's vital forces by himself, those human vital forces turn out to be of incomparably higher value and manifest a greater ability to serve the aforementioned common good than the corresponding value and ability in other people who are not so organised.

Such other people, who have not had their vital forces developed and organised by our own forces, are often in the same or even in a worse position than land that is uncultivated

as regards their faculty to apply their forces. For uncultivated land, which as is well-known does not yield a harvest of cereals, nevertheless brings forth grasses and herbs, bushes, trees, and other such like beautiful and useful produce; whereas people who are badly educated and not organised, in other words whose vital forces have been neglected or are badly managed, very often not only bring no profit or gain, but are even harmful as regards the common good.

This is clearly the outcome of the failure of our vital forces to exert an effect on their forces; or it may be the result of an inappropriate application of those forces. For it is well-known that the earth's yield is meagre or none at all not only when we have neglected its fertility, but also if we have applied our four vital forces in an inappropriate manner, contrary to the nature of the land and the crops which are to grow on it.

If it is indeed so – and hardly any who considers it well shall have any doubts – as has been shown on the example of the earth, the animals, and mankind, that by the *application of our forces on the external forces of Nature, living and inanimate, these latter forces, and hence also the things and the creatures in which they are lodged and through which they manifest their visible effects, acquire a greater value or ability to serve the common good the more efficiently and the more appropriately we exert our own vital forces upon them*; if it is indeed so, then the exertion of our vital forces for the common good, which is called work, deserves our special and scrupulous attention. All the more so as by such exercise we gain still one further advantage profitable and useful for the common good, for, *like the magnet*, the magnetic force of which, as is well-known increases through habitual use, we shall *promote and augment the vital forces within us by their frequent employment, and in consequence we shall achieve an ever greater and more effective increase in the value or virtue of other things and other people, determining their ability to serve the common good*, to which everything is devoted, following the goodness of God, and to which thanks to Man the most perfect creature made in the likeness of God more and more may and should be devoted.*

The importance of the proper exercise of our vital forces here described, the importance of our work, by which we are

*) To this property of advancement in the human vital forces through their working on the forces of other creatures and things, which resembles the properties of the magnet, we particularly draw the attention not only of the philosophers and the economists, but also of the natural scientists.

to bring and encourage other things, and other creatures like unto us or not, to work, that is to exercise their own vital forces for their own, our and the common good, supplies the reason and strong incentive for us to undertake this work of scholarship on work, and even to establish a new discipline regarding a subject which is of no lesser significance than other subjects of scholarly inquiry, not to mention its superiority over other questions of lower standing which merely entertain our curiosity but do not show us what we are to do and how we are to act in this age in which we are now living and which we call the Age of Action; how we should live to make our lives as bountiful as possible at the least expenditure of toil and with the greatest inner contentment, bringing forth fruit for our own and for the common good; ultimately with all due equity to be judged by others and by our own consciences.

Lest this **Science of Work**, understood as Work in the comprehensive and integral sense, not merely its part that is physical labour or *toil*, but physical, aesthetic, rational, and moral work, that is *Labour, Entertainment, Reasoning*, and

Dedication, that is Work to be performed by all the forces assigned to us by our Maker and to relate to all the purposes of our existence as intimated by pure religion and an untarnished sense of personal dignity – lest this Science of Work deter us both by its novelty and by its expansiveness, we shall first give its brief outline or structure, and then, if it prove necessary, we shall expound and develop the subject more fully.

The Science of Work, or more accurately works, which we shall venture to call Ergonomics, after the manner of the other sciences, from the Greek *έργον* – work, and *νόμος* – principle or law, is similar to the Ananconomics, or the Science of the Needs which we presented a decade ago, because together they form one Science of Life, that is Bionomics, and are sustained in a quaternary composition because life is determined by the operation of the four already-described vital forces to which all that is in nature corresponds, and by which we and our fellow creatures attain to all that is good for ourselves and for the common welfare.

AN OUTLINE OF ERGONOMICS, Or THE SCIENCE OF WORK

Work is the mother of all good.

1) By the term **Ergonomics**, derived from Greek *ergon* (*έργον*) – work, and *nomos* (*νόμος*) – principle or law, we mean the Science of Work, that is the use of Man's forces and faculties with which he has been endowed by his Maker.

2) The **Science of Work**, understood in the widest possible sense of the term "work", may be divided into two main disciplines, the science of useful work, which brings improvement or is commendable, by which we mean the good use of Man's forces and faculties with which he has been endowed by his Maker, or their use for the common good; and the science of harmful work, work that brings deterioration, and discreditable work, by which is meant the contrary use and intention to use the said forces and faculties.

3) **Useful work**, which is the only kind of work we shall discuss here as the good from which all other goods come, and which rests chiefly in the improvement or perfecting of things, people, and ourselves, is divided, in accordance with the nature of the forces we devote to it and under whose guidance we carry it out; namely into:

Physical, Aesthetic, Rational, and Moral Work;

that is, Work which is

Kinetic Emotional Intellectual and Spiritual,
or *Motory, or Sensory, or Rational,*

and which may otherwise be known as:

Labour Entertainment Thinking and Devotion
or **Toil, or Pastime, or Reasoning, or Dedication**

4) In each of these kinds of work, examples of which are as follow:

the breaking of stones,	the playing with stones,	the investigation of their natural properties,	the removal of stones from the road.*
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*) So that they should not give rise to untidiness or of suffering for people or other creatures of God.

there are four chief considerations:

- 1) with what creatures do we share this work?
- 2) in which periods of our lives are we particularly suited for this work?
- 3) in what manner may we proceed in this work? and
- 4) what are the benefits to be drawn from this work for ourselves and the common good?

Chapter I

The Shared or Common Nature of Human Work with the Work of Other Living Creatures

5) The four kinds of work just mentioned above, that is *Labour, Entertainment, Reasoning, and Dedication*, are the categories of our own and the general employment; such that the first category is performed chiefly by our *motory* forces, which we share with all the living creatures, that is plants and vegetables, primitive animals, animals, and humans; the second category is accomplished chiefly by the *sensory* forces, with which we and all the creatures capable of feeling have been endowed, that is humans and the animals and primitive animals; the third is done chiefly by the forces of *reason*, which has been given to all the thinking and reasoning creatures, that is to humans and to the animals; and the fourth is carried out chiefly by the *spiritual* force, which has been apportioned only to the creatures capable of self-dedication to the common good, and such are only human beings. Therefore, as has already been said, these four categories of work are divided as follows:

Labour	Entertainment	Thinking	Dedication
may be and is performed by:			

Plants	Primitive Animals	Animals	Humans
Primitive Animals	Animals	Humans	
Animals	Humans		
Humans			

6) The proof of this obvious truth is to be had in the following creatures:

esparto grass	wrynecks	wise serpents,	humans who
earthworms	squirrels	birds, animals,	devote themselves
moles	persons given	and similiary	to work for the
common labourers	to entertainment	humans	common good

The esparto grass which has been mentioned here, like many other plants which send down their roots very deep into the soil, is thus regarded to be performing physical work

or Labour. Esparto grass pierces and shakes the soil with its roots just as the earthworm does, thereby facilitating the penetration into it of rainwater and all the substances washed out of the atmosphere, and contributing very significantly to the soil's fertility. Not only esparto grass and other herbal plants, but all vegetal creatures whatsoever perform this kind of work. The most conspicuous proof of this is offered by the trees, which, when they grow in the ground, push aside and move the soil so mightily with their roots, that even were it as dense as can be, even if it contained boulders, it could never withstand the force of pressure exerted by the roots of trees. And when they grow on rocks trees give rise to the breaking up and splitting asunder of those rocks. Even the herbal plants seem to make no meagre contribution to this process, as evidenced by the name itself of a species of plant which involves many varieties, the Saxifrage species, the greatest number of specimens of which occurs in the rocky parts of high mountain areas, and which appears to be as good at breaking up the rock surface which is softened by moisture as esparto grass and other plants growing in the soil are at riddling the earth with their roots. And then upon the decay of those roots not only do they enrich the soil with their remains, but they also leave a network of orifices through which rainwater seeps in more easily. The rainwater in turn makes the soil moist and also more fertile through the draining into it of all the atmospheric gases and emanations in the atmosphere from the burning, fermenting, decomposing, evaporating and respiring creatures, living or dead.

As we have proved with unquestionable examples, and in accordance with our profoundest conviction, the *Plants*, along with all other living creatures, are engaged on motory work, otherwise called *Labour*. Likewise we could prove that the Lower or *Primitive Animals*, along with all creatures capable of feeling, busy themselves with the work called *Entertainment*; that the *Animals*, along with all the creatures capable of learning, are involved in the intellectual work called *Thinking*; while only *Man*, that is human beings, busies himself with spiritual work otherwise known as *Dedication*. However, since this matter calls for a rather extensive discourse supported by numerous examples to demonstrate its truth, it cannot be entailed in the outline of the Science of Work, but rather in its exposition, which does not concern us here, and the subject of which, relating to the nature of the work carried out by the four kinds of living creatures,

may be found by the reader seeking enlightenment on the matter in our *General Natural History* in Jaworski's Yearbook for 1857.

Chapter II.

On the Aptitude of Humans to Undertake Various Kinds of Work in Particular Periods of Their Lives

7) Since the physical or motory force manifests itself in humans in the active condition in all periods of their lives, that is both in infancy, youth, maturity, and old age; the aesthetic or sensory force manifests itself only in the last three periods; the intellectual or mental force manifests itself chiefly in the last two periods, that is in maturity and old age; and the spiritual force manifests itself chiefly (at the present stage of Mankind's history) only in old age,* hence the four above-listed types of work, viz.

Labour Entertainment Thinking Dedication, which are carried out chiefly by the corresponding force, or under its leadership, are carried out, or at any rate are most frequently carried out by Man in his

<i>infancy</i>	<i>youth</i>	<i>maturity</i>	<i>old age</i>
<i>youth</i>	<i>maturity</i>	<i>old age</i>	
<i>maturity</i>	<i>old age</i>		
<i>old age</i>			

A proof for the four circumstances in which Man undertakes work is supplied by the following example:

The taking and eating of useful things**	Passing one's time on things which are pleasant and beautiful	The examination of unknown and interesting things	The bringing of all things to serve the common good
--	---	---	---

*) A proof of this is supplied in this age by the disposition developed chiefly in aged persons, to undertake even small tasks of dedication for the common good, such as the removal of stones from the road into a stream, that is the elimination of harmful conditions in favour of generally useful conditions.

**) The taking and eating of useful things, and the similar performance of all mechanical activities by means of the motory force alone is manifested not only by all *humans*, but also all the living creatures not excepting the *plants*, as evidenced for example by the flycatcher (*Dionaea muscipula*) and all the varieties of the sundew (*Drosera*).

Chapter III

On the Methods in Which the Four Kinds of Work may be Performed

8) There are four chief methods whereby Humans may undertake, and indeed do undertake work, viz.,

The First Method

when they carry out the kinds of work already defined as

Labour Entertainment Thinking Dedication

solely by means of the corresponding main force, that is by the

<i>Motory</i>	<i>Sensory</i>	<i>Intellectual</i>	<i>Spiritual</i>
<i>force</i>	<i>force</i>	<i>force</i>	<i>force</i>

In such cases only a minimum effect, or even no effect at all is achieved, for at least the three latter forces, unless assisted by the motory or *executive* force, cannot bear any fruit, they cannot perform any useful deed for the common good.* The forces corresponding to these three kinds of work, namely the sensory, intellectual, and spiritual forces, have no power to effect; they are merely such powers the first of which *encourages* or *incites*, the second of which *manages* or *guides*, and the third of which *sanctifies* or *devotes*.

The Second Method

9) The second method of undertaking the four different kinds of work is the one undertaken, as in the previous instance, through the corresponding or chief force assisted through the support of the lesser forces, viz. when the four kinds of work, that is

Labour Entertainment Thinking Dedication may be regarded as manifestations of the following human forces:

<i>motory</i>	<i>motory</i>	<i>motory</i>	<i>motory</i>
	<i>sensory</i>	<i>sensory</i>	<i>sensory</i>
		<i>intellectual</i>	<i>intellectual</i>
			<i>spiritual</i>

or in other words of the following forces:

<i>executive</i>	<i>executive</i>	<i>executive</i>	<i>executive</i>
	<i>inciting</i>	<i>inciting</i>	<i>inciting</i>
		<i>guiding</i>	<i>guiding</i>
			<i>sanctifying</i>

(to be continued)

*) Without the exertion of the motory force it is impossible even to speak or write.

Vignette of the weekly *Przyroda i Przemysł* (Nature and Industry), No. 30, 1857, in which the second part of Wojciech Jastrzębowski's article "An Outline of Ergonomics, or the Science of Work" (original title "Rys ergonomji czyli nauki o pracy") was published.



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przystępnemu wykładowi wszystkich gałęzi nauk przyrodniczych, praktycznemu ich zastosowaniu do potrzeb życia,
tudzież najnowszym odkryciom i wynalazkom.

Rok 2.

N^o 30.

1857.

AN OUTLINE OF ERGONOMICS,

Or

THE SCIENCE OF WORK

based upon the truths drawn from the Science of Nature

by

Wojciech Jastrzębowski
(continuation)

This will ensue when the different kinds of work are combined; namely, the first kind with toil; the second with toil and pleasure; the third with toil, pleasure, and thought; and the fourth with toil, pleasure, thought, and the love of the common good, that is such good which only man can know and love, and which is unique in that it contains all other goods, chiefly the following four: the glory of the Supreme Perfection, the good of our neighbours, the good of our fellow creatures, and our own good.

In this manner the four mentioned kinds of work are undertaken. All of them are activated by the *executive* force; while the latter three are also supported by the other superior forces; and they shall be bound to render their fruit unto us, all the more bounteously the more forces there are contributing to its achievement.

The Third Method

10) The third method of performing work is when we carry out the different kinds of work in the manner described above but also avail ourselves of the assistance of the forces of other living creatures, that is:

Plants	Primitive Animals	Animals	Humans
endowed, as we know (5), with the following forces:			
<i>motory</i>	<i>motory</i>	<i>motory</i>	<i>motory</i>
	<i>sensory</i>	<i>sensory</i>	<i>sensory</i>
		<i>intellectual</i>	<i>intellectual</i>
		<i>spiritual</i>	<i>spiritual</i>

and hence able to undertake, like ourselves, the kinds of work corresponding to these forces. Other creatures may thus be helpful to us, or at least they can encourage us in our work by their example and induce us to lead a more active life which will yield a richer harvest than when we are relying solely on our own forces in our work and when we receive no external encouragement.

The Fourth Method

11) The fourth method of undertaking the four above-mentioned kinds of work ensues when we perform work in

the manner described for the two previous instances, but in addition enlist the forces of inanimate Nature, for example the force of steam, wind, water, gravity, or cohesion; or crystalline, organic, electrical, magnetic force etc. Even if we do not use these forces directly, we endeavour to copy the works produced by these forces, in the production of which the following forces of Nature are particularly manifest:

<i>attractive</i>	<i>cohesive</i>	<i>crystalline</i>	<i>organic</i>
or in other words,			
<i>the drawing</i>	<i>the joining</i>	<i>the ordering</i>	<i>the vitalising</i>
<i>force</i>	<i>force</i>	<i>force</i>	<i>force</i>

for it is precisely these four forces or powers of Nature which give rise to and sustain in the true sense of the word such things as, for example

air	ice	snow crystals	insects trapped in amber
water	chalk	crystalline salt	mammoths
the soil	marble		ammonites
clay	flint		
sand	sandstone		

which things are commonly know as:

the *Elements, Stones, Crystals, and Fossils,*
or the inanimate entities the forms of which are:

variable	stable	regular	derived from
		or ordered	biological forms

or, in yet another classification, they are:

originals rocks orders images

which, even if they were all to consist exactly of the same type of material, e.g. silica in

sand	sandstone	rock crystal	silica fossils
sandy soil	flint	amethyst	

although they are all composed of silica, yet each conveys an entirely different property. The cause of this is the fact that each of the four arise through the action upon matter of the four different forces just enumerated, not acting in isolation but in their consecutive order. Thus the **Elements** are the product of the *attractive force*; the second entity, named the **Stones**, is made as a result of the action of the *attractive and cohesive forces*; the third, the **Crystals**, come about as a result of the action of the *attractive, cohesive, and ordering forces*; and the fourth entity, the **Fossils**, is produced when matter is acted upon by all four forces, the *attractive, cohesive, ordering, and vitalising force*.

12) These four different things, created in the described manner by the four above-described forces, are characterised

Chapter IV

On the Advantages Accruing from the Undertaking of the Four Described Kinds of Work

15) There are four chief advantages or benefits which may and indeed do proceed for us from the undertaking of the four described kinds of work, in other words from the good use of our corresponding four vital forces, assisted by the forces of the external world, and these advantages are our **Property, Ability, Perfection, and Felicity**, which are the same as our *external good, our first inner good, our second inner good, and our third and supreme good*.

1. Property

16) *Property*, otherwise known as the *external good or asset*, is acquired by each of the four described kinds of work, viz.

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but it is not achieved in equal proportions by each of them. For if we apply them in the second manner of work described above in (9) of the preceding chapter, that is not in isolation but in an increasing combination of the four kinds of our vital forces, then the outcome of such work, even though it be concentrated on one object, shall be all the greater the greater the participation in it of the four vital forces, according to the relation which has already been shown on the particular examples and unquestioned facts cited in the essay on *Man's vital forces and their significance in his productive or creative livelihood*. These facts and particulars show, for instance, that land which is cultivated by the application of the first of the vital forces, that is *Labour, the work which uses only one vital force*, usually produces (in outcome of its natural fertility being thereby enhanced) two seeds of crop for every seed sown; whereas land cultivated also with the application of Entertainment, Reasoning, and Dedication, in other words work engaging two, three, and four vital forces, for every seed sown yields harvests in a ratio of 4, 8, and 16. This shows that each successive vital force applied to the working of the land to enhance its fertility doubles the preceding outcome. Other forces may be utilised in this manner on all the other things of this world, both animate and inanimate, that is on the one hand, on the

originals rocks orders images,

and on the other hand on the

Plants Primitive Animals Animals Humans

outside of which there are no other categories of things in this

chiefly by the circumstance that their natural properties, otherwise known as their lesser or internal properties, consist of an increasing number of qualities proper to inanimate objects and things which have devolved to the inanimate condition, and which may be described as follows:

<i>variable</i>	<i>variable</i>	<i>variable</i>	<i>variable</i>
<i>stable</i>	<i>stable</i>	<i>stable</i>	
<i>ordered</i>	<i>ordered</i>		
<i>vitalised</i>			

13) As regards their usefulness or purpose, or their external and superior properties, these four entities are distinct from each other most of all in that if we make active use of them, in order to improve or copy them, or to obtain other objects like unto them as regards the qualities of *variability; variability and stability; variability, stability and regularity; and variability, stability, regularity and vitalisation*, as for example:

cultivated land	artificial rocks	ornaments and utensils	mummified &
fertilisers	man-made caves	tools and instruments	embalmed bodies
food and drink	ruins and debris	edifices	pictures & statues
			machines

— we shall of necessity be applying our vital forces: our first force in the *first* case; our *first* and *second* forces in the second case; our *first, second, and third* forces in the third case; and *all four* of our vital forces in the last case, that is:

<i>motory</i>	<i>motory</i>	<i>motory</i>	<i>motory</i>
	<i>sensory</i>	<i>sensory</i>	<i>sensory</i>
		<i>intellectual</i>	<i>intellectual</i>
		<i>spiritual</i>	<i>spiritual</i>

or, in other words, the following forces:

<i>fixative</i>	<i>fixative</i>	<i>fixative</i>	<i>fixative</i>
<i>pleasure-giving</i>	<i>pleasure-giving</i>	<i>pleasure-giving</i>	<i>pleasure-giving</i>
	<i>activating</i>	<i>activating</i>	<i>activating</i>
		<i>virtue-endowing</i>	<i>virtue-endowing</i>

14) Thus these four things, or more precisely the four forces to which they owe their creation and properties, may serve us as means to develop our own forces, and hence for their engagement in the carrying out of the four above-described kinds of work (3), and for the yielding of more and more abundant and useful fruit for the common good, the further we will manage to develop that application, and the more we will manage to engage other forces appertaining both to living and inanimate Nature, in the process.

earthly world, and which therefore constitute the full scope of our Property. Therefore we have grounds to believe that each of these eight earthly things and creatures may have its value augmented in the following ratio:

2 : 4: 8: 16;

or in some other similar ratio when we act on it by means of work engaging

one force two forces three forces four forces
that is,

Labour Entertainment Thinking Dedication,

that is, endeavouring to enhance the value of each of the eight earthly things through the following of our forces:

motory motory motory motory
sensory sensory sensory
intellectual intellectual
spiritual

or, in other words, through the following forces:

performing performing performing performing
activating activating activating
directing directing
virtue-endowing

or, to use foreign loan-words, the forces that are

physical physical physical physical
aesthetic aesthetic aesthetic
intellectual intellectual
moral

2. Ability

17) The second chief advantage which we draw from work is that through it we acquire the skill to perform work itself more and more easily and with an ever-growing satisfaction, accuracy, and liking for it. In other words that we can and are able to undertake work at the expense of a lesser and lesser amount of toil and drudgery, but to the ever-increasing gain of ourselves and the common good. Such an aptitude for the undertaking of work with an ever-increasing facility, satisfaction, accuracy and liking, and with the ever greater saving on effort, time, and material, is called *Ability*, and is our *first inner good* (15), which is acquired, just like *Property* or the *external good*, by each of the four described kinds of work, that is by work which engages

one force two forces three forces four forces
that is,

Labour Entertainment Thinking Dedication.

But *Ability* will not always be of the same import to us. For if

it is the result of the first of our kinds of work, it will be called a *Craft*. If we apply the second, third, and fourth kinds of work respectively, the applicable names for the corresponding abilities will be decorative *Art*, precise *Skill*, and exemplary *Conduct*.

18) The above shows that just as we have four different kinds of work, so too there are four different aptitudes or abilities for their performance, that is the above-mentioned

useful decorative precise exemplary
Craft Art Skill Conduct

These abilities will be all the more important to us the more we endeavour to devote of our forces for their acquisition, or at least the more we strive to make them the outcome of our undertaking of the four kinds of work; not by the *first manner* for the performance of work (8), which in Chapter III we found was the least effective of all, or even totally fruitless; but by the *second, third, and fourth means* (9, 10, and 11), requiring the application not only of the *physical, aesthetic, intellectual, and moral* forces, but also of other, inner or external forces; or by the combination of the latter with the former if they may profitably be used in combination. This applies particularly to the latter, that is the inner forces, which only then attain their true qualities in the sense of the work referred to as

Labour Entertainment Thinking Dedication,

and may serve as means for the acquisition of our first internal good, known as *Ability*, and in particular

useful decorative precise exemplary
Craft Art Skill Conduct

when they are combined in the way described above in Chapter III, with the use of the second manner of undertaking the four kinds of work just mentioned. For it is only when these forces are combined in this manner that we may perform any of our life's jobs, tasks, professions or offices with the application of

toil toil toil toil
satisfaction satisfaction satisfaction
cogitation cogitation
love.

In other words, we shall then be applying a greater and greater number of the forces given us by our Maker, by which these forces will be developing more and more within us, which in turn will become the source of an ever-increasing store of *Ability*. The result of this for us will be not only that the

profession or occupation to which we devote our entire lives will be not merely mechanical or in other words motory and pertaining to the *crafts*; but it will also be motory and sensory, in other words *artistic*; or it will be motory, sensory, and intellectual, in other works *skilled*; or finally motory, sensory, intellectual and spiritual, for which no other appropriate name exists at present in this or any other language we know. For this profession, which will only emerge from the state of slumber in which now it persists, at some future time, when the spiritual or moral force attains its rightful place, which is now usurped by the intellectual force of reasoning; and when the moral force becomes as active as the motory, sensory, and reasoning forces, in other words as the mechanical, aesthetic, and intellectual forces. It is by these three last-mentioned forces that in this the third era of man's history* that the useful *Crafts*, the decorative *Arts*, and the precise *Skills* flourish and thrive. But when the fourth era comes** it will no doubt come to the blossoming of the exemplary *Sciences, Conduct, and Deeds*. This may first be expected to come about within our virtuous agrarian Slavonic people and its noble and most innocent occupation of agriculture; an occupation which, since it may be conducted not only industriously as a useful *Craft*,

not only industriously and with taste as a decorative *Art*, and not only industriously, tastefully, and skilfully as a precise *Skill*, but also honestly as an exemplary *Science* — will in time acquire that ultimate, and most noble quality, thereby providing an example for other occupations to follow. To this Mankind will be drawn not only by the awakening in those people who practise these abilities of a sense of Man's dignity in his position as the most perfect creature and therefore also the creature expected of the best conduct; but Mankind also will become aware of that important circumstance, especially as regards its material condition, that the outcome of human work in any profession or occupation whatsoever is all the grander the more people come to activate their forces for the acquisition thereof, that is the more they perfect their active, productive, and perfecting forces, the aims and purposes of which are to better things, people, and their own persons and hence also their own and other people's aptitude to serve the common good. Thus they will strive to raise themselves from the state of vegetal or mechanical activity to the state of mechanical, sensory, intellectual, and moral activity, which is the truly human business and the emblem of a truly Christian life founded upon the principle of serving with all of one's forces for the common good, which is the work of God, Guardian of this good, Who has made Man in His own image and likeness, wishing to have him as His helper to care for and attend to this business.

(to be continued)

*) That is the Industrial Age, which has followed on the Barbarian Age, which in turn came after the Savage Age.

**) Which shall be the Age of Accomplished Christianity or the Age of Universal Love.

Vignette of the weekly *Przyroda i Przemysł* (Nature and Industry), No. 31, 1857, in which the third part of Wojciech Jastrzębowski's article "An Outline of Ergonomics, or the Science of Work" (original title "Rys ergonomji czyli nauki o pracy") was published.



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3. Perfection

19) The third chief advantage, known as *Perfection* (15), ensuing from the undertaking of work, or in other words from the good exercise of our vital forces, somewhat resembles the second advantage, *Ability*, but differs from it in that while *Ability* is often regarded as an external as it were property of ours (as the names of its four main kinds* indicate), thus separate from us and often finding external expression, either through writing or other means; *Perfection* on the other hand, the advantage now under discussion, is always seen as one of our inner properties, a thing strictly connected with us and a direct consequence of *Ability* in the entire range of its senses as evidenced by the Crafts, Arts, Skills, and Sciences, and an indirect outcome of *Work* or the good exercise of our four vital forces, known as the physical, aesthetic, intellectual, and moral forces.

20) Thus *Perfection*, which is now under discussion, is the fruit of our *work*, in other words the outcome of the above-mentioned forces which always constitutes an integral part of our being, considered in that state which it may and should attain as our forces grow, and therefore known as the potential for growth and development. This potential for development, we observe, is the condition for *Perfection*, which is the chief ornament of our being and the principal condition for our *Felicity*, which we shall discuss in due course.

21) *Perfection* is acquired like *Ability*, through the exercise of each of the four different kinds of *Work*, viz. by work that is

motory sensory intellectual spiritual

or in other words through:

Labour Entertainment Thinking Dedication (3)

But it will not be of equal import to us, for if it is the fruit of

*) That is the Crafts, Arts, Skills, and Sciences.

the first kind of work, or the effect of the exercise of the first kind of our *Ability*, that is a Craft, it will be known as health, wholesomeness, perseverance in toil, fitness, firmness, soundness, and most aptly *Efficiency*. But if we may regard it as the outcome of our second, third, or fourth kind of work, or as the effect of our application to the second, third, or fourth kind of *Ability*, that is to the Arts, Skills, or Sciences, that *Perfection* will be known in the first case as taste, decorum, courtesy, politeness or *Affability*; in the second case as wisdom, prudence, proficiency, faculty, or *Capability*; and in the fourth case [sic] goodness, mercy, humanity, equity, honesty, or *Virtue*.

22) Hence it may be observed that just as there are four chief kinds of our *Work* and four corresponding *Abilities*, so there are derived from them four kinds of our *Perfecting*, the above-cited

Health Taste Wisdom Goodness
or,
Efficiency Affability Capability Virtue or Worthiness

23) Apart from their absolute value, by which our being is endowed with a similar value, these *Perfections* also have a relative value, which concerns the objectives of our active, improving and productive life, the chief purpose of which is to *bring people and things away from the harmful or neutral state, and from the state of little utility, to the state of their being most useful and best suited for the common good, which contains our own good too as a constituent part of its entirety.*

23) The latter of these values, that is the relative value of the four *perfections*, may be learned from the very names used for them. The first of the *Perfections* is called *Efficiency*, since it makes us fit to carry out or effect the most difficult tasks without strain, fit to accomplish without fatigue even the most arduous tasks or useful work the aim of which is to make people and things useful, or to make people and things serve the common good. The second perfection is called *Affability* because if we are endowed of it, it will assure us of acceptance and favour by other people and beings capable of feelings, thereby making them assist us in the performance of the above-mentioned useful work more readily than if they were indifferent to us or did not like us. The third of our four *perfections*, *Capability*, is so named because it helps to make us more capable to render service to other people for the common good than merely as simple performers

of useful work; so that apart from being endowed of the first and second perfection, that is of *Efficiency* and *Affability*, we should also be the capable managers of our own and all other forces by which that work is carried out. Finally the fourth kind of our universal *perfections* is called *Virtue* or *Worthiness*, goodness or humanity, because if we are endowed of it, it makes us behave in such a manner in the referring of our own and general affairs to the common good that we come to be invested with the supreme virtue or worth, at least in the eyes of other people who also act in this way. *Virtue* or *Worthiness* is the only good which deserves the name of "good" of all people, since to this alone all peoples have given the appellation of "goodness". And since it is also called humanity, which term may not be applied to the other three *perfections*, *Efficiency*, *Affability*, and *Capability*, as these we share with other living creatures, therefore *Virtue* or *Worthiness* is a distinctly human quality, one which marks humanity more distinctly among the other creatures than reason or speech, which hitherto have been recognised as the chief factors distinguishing Man from the animals. But the first three *Perfections* alone, that is *Efficiency*, *Affability*, and *Capability*, can never give Man the right to call himself a humane, good, or virtuous creature, be these three *perfections* ever so patently manifested in him.

4. Felicity

24) *Felicity*, which is the fourth chief advantage, the fourth chief good which ensues from *work*, and by which we mean the ultimate and supreme contentment we receive from what is external and what is in us as the fruit of our industry that is of our good and active will to use the forces and faculties given us by our Maker; that *Felicity*, like the three preceding goods, that is *Property*, *Ability*, and *Perfection*, may be acquired by each of the four above-described kinds of *work*, that is by work which is

motory sensory intellectual spiritual

or in other words through:

Labour Entertainment Thinking Dedication;

but that *Felicity* will not be of equal value, that is it will not mark the same state of our contentment and beatitude, but will depend on the nature of the kinds of *work* or of the corresponding forces which we apply to achieve that *Felicity*.

25) If *Felicity* is the fruit of the first kind of work, that is *motory* work or *Labour*; or in other words, if that *Felicity* is

the direct outcome of the *Perfection* acquired by that work which is called health, wholesomeness, fitness, firmness, soundness, or *Efficiency*, then that *felicity* will be of that same import to us as it is to every healthy creature which enjoys its health and the attributes governed by health achieved through the undertaking of motory work. Since this kind of work may be undertaken even by the plants, and also by humans who abide in a somnolent state, merely moving about but neither feeling, thinking, nor loving aught, when they merely apply their physical force only without the three superior forces; since therefore, as I say, such work may be undertaken by the plants and humans abiding in a vegetative condition (the proof of which, in the former case, is the already-mentioned perforation of the soil effected by the roots of plants, or the motion of the blossoming sunflower as all day its head follows the sun, or the rising up off the ground of any young shoots that might perchance have been pushed down or dropped); hence the *Felicity* which is the resultant of this kind of work and which is called *Merriment*, is such a form of general *felicity* in mankind and other beings that it may be manifested by creatures not employing the sensory, intellectual, and spiritual forces, that is the aesthetic, rational, and moral forces, but merely exercising their motory or mechanical force.

26) Since even the plants are also endowed of this force (the proof of which is supplied, apart from the three above-quoted instances, by 1. the movement of their roots during sprouting downwards into and towards the fertile soil, and of their stems upwards and towards the sunlight; 2. the movement of their young stems, shoots and leaves upwards towards the sunlight and away from the darkness; 3. the opening up of their blossoms in the daytime and during fine weather, and their closing up for the night and during inclement weather; 4. and finally their surfacing in the summer (for the water-growing species) and submerging for the winter after the flowering season is over etc.); since, as I say, even the vegetable creatures are endowed of this force, therefore even they can manifest the *felicity* which comes of the happy condition of this force, and after the manner of a healthy, sleeping infant, they too may be said to be merry.

27) This, too, is commonly observed in them when they are in their healthy condition; and furthermore it is attested by the nature of our speech, which allows us to call trees and other plants which enjoy the described *Perfection* or *Health*

merry creatures, thereby granting us the right to acknowledge their potential for the exercise of the first kind of general *Felicity*, which we have called Merriment and which is regarded both in these and in all other creatures and in Man himself as the indirect outcome of the undertaking of the *work* known as Labour, exercised by the *Ability* known as Craft, and therefore the direct consequence of the *Perfection* thereby accruing and named Health or Efficiency.

28) If our lowest *Felicity*, which has just been described, accordingly may be said to be a felicity bereft of feeling and thus a vegetal kind of felicity, as the ultimate outcome of the application of our lowest force known as the motory force or Power which we share with the plants, and the direct outcome of the physical work known as *Labour*, or of the livelihood pursued through Labour, that is Craft, and of the resulting *Perfection*, which we have called health, wholesomeness, fitness, firmness, soundness, or most aptly *Efficiency*; then presumably it must be no otherwise with our second *Felicity*, the sensory Felicity which we share with the primitive animals, and which by analogy with the name for the first felicity, we may call sensual felicity or Delight.

29) Indeed, this second felicity may not be assigned any another source but our second vital force, the sensory force or Sensibility, which we share with all the animals capable of feeling, and hence even with the least of them, that is with the Primitive Animals. Since the sensory force is the essence of the *Work* known as Entertainment, which is also performed by the Primitive Animals, as evidenced by the animated movements these creatures carry out reminiscent of our dances, such as the somersaults in the air done by insects like Hilara and Chironomus, or the leaps over water by the insect Gyrinus; or by the pleasant sounds similar to our music uttered of a summer's evening by the crickets, Cicada orni and Acridium Viridissimum; therefore Entertainment should be regarded as the source of the *felicity* described, and known as Delight. And since of this all are thoroughly convinced, it wants no further proof. Furthermore, since Delight is closely connected with the *fair Arts*, as confirmed by the just quoted dancing and music, which at the appropriate level of perfection are accounted even as belonging to the sublime arts; therefore the similar yet even more perfected or profuse Arts show they are derived from Entertainment as the source of their *Felicity*.

30) And since in addition from Entertainment and the Arts a third good issues, namely the sensory Perfection,

or taste, decorum, courtesy, politeness or Affability, which wins for us the acceptance and favour of other people and other creatures capable of feeling, therefore also this third good may and should be acknowledged as the source of the *Felicity* under discussion, that is Delight. Of this all are thoroughly convinced, for whosoever possesses this Perfection, or has ever in any way contributed to the pleasure of other people or creatures endowed with feeling knows how much innocent pleasure or Delight he himself has thereby received. According to what has been said of it here, Delight is a likewise a fruit or outcome of the good exercise of our second vital force which we share with all creatures endowed of feeling; just as Merriment is the fruit or outcome of the exercise of our first vital force, which we share in common with all living creatures. If this is how things stand with the first two kinds of our general *Felicity*, that is Merriment and Delight, then it can be no otherwise with the two superior Felicities, that is intellectual felicity and spiritual felicity, or respectively Consolation and Joy, which we shall now briefly discuss.

31) The first of these latter felicities, and successively the third felicity, is called intellectual felicity because by analogy with our first and second felicities, Merriment and Delight, which correspond to their respective vital forces and which we share with all living and feeling creatures respectively (that is the plants and the primitive animals) — it is an outcome of our third vital force, the intellectual or rational force, which we share with all the creatures capable of thinking, that is with the Animals. And since this third vital force, otherwise known as capacity or docility, is the essence of the corresponding *work*, that is Thinking, which is practised by the Animals as well, especially when they lay snares for animals that are more powerful than they; therefore this kind of *work* too may be the source of a *Felicity*, the one now being discussed and called Consolation. For we are made happy or pleased by our rational force when, having developed that force appropriately for the undertaking of the given work, we make plans to benefit or hurt other creatures, and discover the appropriate means to carry out those designs.

32) This also applies to the Animals, since (as may be observed in trained dogs) they too experience the highest *Felicity*, superior to the ordinary felicity of the senses, that is superior to Delight, when they can do something witty for themselves or for us. And the fact that, along with human

beings, animals too achieve such things, is the result of their *ability* or Skill. This Ability is demonstrated, for instance, by skilled hunters and the dogs and hawks trained by them for the hunt. Therefore this kind of *Ability* may be and indeed is for us humans and for the animals as well a source of the *Felicity* known as Consolation.

33) As the described *Ability* or Skill denotes the same as the *felicity* of the intellect, generally known as proficiency, wisdom, learning, or most aptly Capability, which makes ourselves and the Animals capable of carrying out more than just the simple, repetitive and mechanical tasks (viz. such that may be carried out by a machine), therefore this *Perfection*, attained by the exercise of the kind of *Ability* corresponding to what we call the exact Skills, should be regarded as the means — more direct than the *Work* known as Thinking which marks this category of *Ability* — to achieve that general Felicity of the intellect known as Consolation.

34) This Consolation, we observe, is a far higher kind of our general beatitude than Delight, the felicity of the senses; or than Merriment, the felicity of movement, which we may exhibit even when asleep, through a pleasant disposition of the features of our countenance, and which may be considered desirable merely because it is a sign of health and because

through it we may stimulate the higher felicities in other people, such as the felicity of the senses, which may be evoked even by the merry plants that enjoy this Merriment thanks to their health, although they presumably do not feel this, yet manifest it to other creatures that are capable of feeling.

35) Thus if our first three vital *forces*, that is Physical Motion, Sensibility, and Intellectuality, which are the essences of the first three categories of *work*, that is Labour, Entertainment, and Thinking, and also of the first three kinds of *Ability*, that is the useful Crafts, the decorative Arts, and the exact Skills, are the sources of our first three *Perfections*, known as Efficiency, Affability, and Capability, and hence also of the directly resulting first three *Felicities*, that is carefree Merriment, innocent Delight, and lofty Consolation; and if, now, the fourth of these forces which vitalise us, Spirituality or the moral force, is the agent within us of the *work* known as Dedication, thereby evoking that general *Ability* of ours known as the exemplary Sciences, and the fourth kind of our *perfection*, which we have denoted by the terms goodness, humanity, or Virtue; it may not be doubted that this force is correspondingly the fount of a separate Felicity.

(to be continued)

Vignette of the weekly *Przyroda i Przemysł* (Nature and Industry), No. 32, 1857, in which the final part of Wojciech Jastrzębowski's article "An Outline of Ergonomics, or the Science of Work" (original title "Rys ergonomji czyli nauki o pracy") was published.



A. L. W. DOBCKMANN SA

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tudzież najnowszym odkryciom i wynalazkom.

Rok 2.

N^o. 32.

1857.

AN OUTLINE OF
ERGONOMICS,

Or
THE SCIENCE OF WORK

based upon the truths drawn from the Science of Nature

by
Wojciech Jastrzębowski
(final part)

36) In our own tongue, Polish, apart from the terms Merriment, Delight, and Consolation, we have another homonymous word, that is Joy [*Radosć* – Lat. *gaudium*, translator's note], which nevertheless denotes something superior and occurs especially in our ancient books, such as the translations of the Bible. This is the word most frequently used to mean the moral or spiritual felicity* – that felicity which is accessible only to the moral creatures, those able best of all to develop their moral force. Only humans, or the humane, most truly human and humanitarian among the humans, may and indeed do experience this, through the accomplishing of the most perfect and sweetest deeds pertaining to the supreme Perfection.

37) If now we consider those deeds by which we perfect ourselves, other people and creatures, and the things pertaining to this world which are in an inferior condition due to human error or negligence or through misadventure, as the highest and sweetest deeds of the supreme Perfection – then that *perfecting of people and things*, that is bringing them from a harmful or indifferent condition, or from a condition of little utility, to the state in which they are most useful and best suited to serve the common good; if, thus, we bring them to that condition in which they carry the traits of the supreme Felicity and its most perfect creature, which we consider (and should out of our religious duty consider) to be ourselves – *we will regard this as the loftiest kind of all our deeds*, the supreme mark of our moral *perfection*, known as humanity, goodness or Virtue, which is the condition for the corresponding *Felicity*, which as has already been said, is called Joy.

38) That Joy – Man's true *Felicity*, which indeed no other being can experience save Man leading a human, humane and humanitarian life, at least at the present stage of Man's development – that Joy is the fruit of its corresponding

Perfection, the reward of perfect deeds, that is such that are intended to bring man and things to perfection, of this none can be convinced by reasoning, that is through the agency of the third vital force, the force of the intellect or of reason, since the latter force is restricted in its powers of judgement only to matters concerning itself or lesser matters. As regards deeds effected by the force superior to reasoning and by its attendant consequences, such matters may be judged only by that self-same higher force. Hence true judgements in such matters may not be expected of Man the Reasoner but of the Dedicated or Devoted Man, that is of him who accomplishes the said perfect deeds, that is such deeds which are intended to bring men and things to perfection.

39) If Man the Thinker, that is those who manifest the working of the third of the vital forces as the supreme emblem of their lives, were to claim the right to judge those who work by Dedication or Devotion, they would thereby invest all those inferior to themselves, that is those whose highest activity is feeling, in other words those who are manifest only through the second vital power, the right in turn to judge the thinkers. But the thinkers would not allow this, and indeed could never allow it, as superior things cannot be known by things that are inferior. Likewise, without insult to common sense, by which no doubt they are ruled, the thinkers should not pretend to make themselves, and the generality of Mankind abiding in the third vital force, true and equitable judges of those dwelling within the realm of the fourth vital power and displaying all the vital forces with which Man has been endowed by his Maker.

40) Now if Man the Thinker, that is those who live by the exercise of the third vital force, were to endeavour truly and equitably to judge the deeds of those who work by Dedication, that is of those whose aim is the perfection of things, other people, and themselves, thereby making them more apt to serve the common good; if, as I say, the former wished to judge the latter, and to enjoy the Felicity enjoyed by the latter, that is Joy; they would only be able to do this if they themselves endeavoured to discover and practise this work, or at least instead of leading their hitherto *partial* life, consisting chiefly of thinking, in other words of carrying out intellectual work, if they endeavoured to emulate at least for a brief time the *full* life of Man, consisting in movement, feeling, thinking, and dedication, that is in the performance of all four kinds of work which humans may

pursue, motory work, sensory work, intellectual work, and spiritual work, in other words Labour, Entertainment, Thinking, and Dedication. They would be qualified to judge in this respect if they themselves enjoyed all the fruits which may be attained through all four kinds of work, that is through the good exercise of all four corresponding forces, assisted by the external forces of nature, and making all four forces their undisputed assets.

41) Of the fruits obtained from Work and otherwise known as the benefits or goods (15), the first is called **Property** or the external good (16), which accrues (as we Poles have observed) in geometrical proportion, that is in relation to the square of the value for the previous vital force, viz. a 2 : 4 : 8 : 16 ratio. This good is the least bound to our nature, since it may be easily lost and easily regained. Nevertheless this benefit called **Property** is an indispensable condition not only for our human happiness, but even of human existence. For no person is able to enjoy a happy life, nor even to live without the external fruits of his own or others' work.

42) As regards the second fruit of our four kinds of Work, which in (11) [! – cf. 18] we gave the general name of **Ability**, and the particular appellations of the useful *Crafts*, the decorative *Arts*, the precise *Skills*, and exemplary *Sciences*; as regards this second fruit, which we have called the first inner good, we know it is much more closely connected with our nature than the former good. For those people who have no permanent **property** at all must have at least a relative mastery of one of the above-described **abilities**, that is of the useful *Crafts*, the decorative *Arts*, the precise *Skills*, or of the exemplary *Sciences*. And whatever profession they have chosen, if they practise it diligently, or both diligently and with taste; or diligently, with taste, and rationally; or diligently, with taste, rationally and honestly – they shall in time acquire such proficiency in their profession that they will soon develop such a liking for their occupation as to consider themselves proponents of one of the four categories of general human **Ability**. We have already explained this for the case of agriculture, which, depending on the four different means of application of our four vital forces, may assume the status of a useful *Craft* as practised by all peoples whatsoever, a decorative *Art* as delineated by Delille in his French *Georgics*, a precise *Skill* in the understanding of Thaer and his disciples, or finally as an exemplary *Science* as presented by Krasicki and Koźmian in their works, *Pan Podstoli* (The Steward) and

Ziemiaństwo Polskie (The Polish Landed Gentlemen) respectively.

43) As regards the third chief benefit which is the outcome of work, that is Perfection (19), which just like work is of a fourfold nature and consists of *Health, Taste, Wisdom, and Goodness*; or *Efficiency, Affability, Capability, and Virtue* (22); as regards this, the second inner benefit, we have no hesitation whatsoever that it is essentially and integrally connected with us, for not only can it not be removed from us once we have acquired it, but without it we cannot exist at all, or at least without it we cannot make any significant contribution to human society nor enjoy a position of respect within it.

44) Since this significant contribution to human society and the related social position are clearly the results of the above-described fourfold **Perfection** known as *Efficiency, Affability, Capability, and Virtue*, without which we cannot effect any good for the well-being of all or win respect, especially of those people who are also in the service of that universal well-being and who therefore have the right to expect us to help them and work with them to achieve that aim; therefore it is clear that albeit this **Perfection**, which we have called the second inner good (15), may seem to be our very own and exclusive good, not shared with any other persons, yet in fact it also belongs to other people, and even partially to our fellow-creatures, too. For they all have a certain right to demand this **Perfection** of us, in return for their own Perfection and the favours granted us thereby.

45) The fourth benefit which we draw indirectly from the **forces** given us by our Maker and from the **work** they accomplish, and hence directly from the **Property, Abilities, and Perfections** (15) thereby acquired; particularly this fourth and last benefit, known as **Felicity** (24), the third inner good, is the most closely related with our nature, apparently pertaining to ourselves alone. For only we ourselves, who have acquired this benefit thanks to our **work and perfection**, appear to be enjoying our own Felicity, while other creatures seem incapable of sharing in our Felicity.

But this is true only of creatures which have no morality, in other words those which have not been endowed with the fourth vital force, or in which this force lies dormant. For as regards all those who partake of this fourth force, manifesting it actively (and this includes above all the humane and

* "The angels shall rejoice at the conversion of one sinner."

humanitarian, truly human people, that is such as, in outcome of an accomplished state of perfection or good education, have activated all their vital forces, including the moral, truly human force, which according to the religious and general conviction they share only with the Heavenly Beings); as regards such moral creatures, who are the most perfect and closest to the Supreme Perfection Itself by virtue of their own perfection, they therefore desire our attaining unto felicity, since without it they can never fully achieve their own perfect felicity, and thus they clearly share in our own state of felicity.

46) This state of affairs should provide us with the best possible incentive encouraging us, first out of regard for ourselves, secondly out of regard for those creatures, and thirdly out of regard for the Supreme Perfection or Divine Goodness Itself, which desires our Felicity and the Felicity of all of Its creatures according to their faculties for the enjoyment of felicity – to strive to attain to our own felicity, the complete felicity for the achievement of which we have been endowed by our Maker of our four vital forces, and which we may accomplish through the performance of the respective kinds of work and hence also through the exercise of the thus accruing Perfections.

47) Since we possess four each of the Forces, kinds of Work, and Perfections, which are the means to our achievement of felicity (and would have less if we were not humans, but animals, primitive animals, or plants; or if by keeping dormant our forces proper to the superior

creatures we dwelled in the condition of the lesser creatures); hence also our felicity must be fourfold in nature, that is

<i>physical</i>	<i>aesthetic</i>	<i>intellectual</i>	<i>moral</i>
<i>felicity</i>	<i>felicity</i>	<i>felicity</i>	<i>felicity</i>
or in other words,			
<i>motory</i>	<i>sensory</i>	<i>rational</i>	<i>spiritual</i>
<i>felicity</i>	<i>felicity</i>	<i>felicity</i>	<i>felicity</i>

The Felicity which we enjoy in common with the four categories of our most perfect fellow-creatures, that is the *Plants Primitive Animals Animals Humans* may be named, in order of increasing power to bring an increasing degree of happiness, to the point of ultimate beatitude, for ourselves and other living creatures:

carefree	innocent	lofty	heavenly
<i>Merriment</i>	<i>Delight</i>	<i>Consolation</i>	<i>Joy.</i>

Above this Felicity none other can be experienced or desired, save perhaps only the assurance that, along with all our neighbours, we shall be able to enjoy for all eternity the ultimate of the four felicities, which may be secured by our and their continual dedication to the common and eternal good. For only through dedication, not by fruitless thinking nor ratiocination and investigation, can we and they be convinced that we hold sufficient power to achieve this, and therefore that we are eternal creatures, and that we are capable of enjoying the Eternal Felicity, which we have just defined as Heavenly Joy.

Editor's note

A reprint of Wojciech Jastrzębowski's article, originally published in Polish in the weekly *Przyroda i Przemysł* (Nature and Industry) in 1857:

- Second Year,
- No. 29, pp. 227-231
- No. 30, pp. 236-238
- No. 31, pp. 244-247
- No. 32, pp. 253-255.

19th century spelling, syntax and layout have been preserved.
Emphasis in the text comes from the author.
Footnotes meaningless to the reader of the English text
have been omitted from the translation.