Appendix A: Naturoids and Music

Reproduction and Transfiguration

According to a well-known anecdote, the music critic Pierre Lalo, after having listened to La Mer by Claude Debussy, declared “I have the impression of beholding not nature, but a reproduction of nature, marvellously subtle, ingenious and skilful, no doubt, but a reproduction for all that … I neither hear, nor see, nor feel the sea” (Vallas 1973). As François Lesure noted, Debussy was trying to express, not the image of the sea, but, rather, its recomposed memory. After all, it is known that Debussy saw music as an art which, perhaps more than any other, is not intended to reproduce nature exactly, but which instead aims at the ‘mysterious affinity between nature and imagination.’ This brief remark could prelude, as has often happened, some subtle analyses of the symbolic or descriptive character of music.

For my part, I would like, instead, to place the matter of the reproductive capacity of music in the more general context of mankind’s attempts to reproduce objects observed in nature, that is to say, to realize naturoids.

It almost goes without saying that I shall assume that musical composition, in common with all artistic composition, possesses all the characteristics of an attempt to reproduce something that, in whatever way we choose to define it, is kept—or, rather, is generated—in the composer’s mind. After all, if art always includes an expressive component, then the artist externalizes or expresses something; that is to say, recalling the Latin roots of the term, he presses something out from himself.

Debussy’s above-cited affirmation is, in this regard, undoubtedly central, because it is the image of a natural phenomenon, and surely not the phenomenon in

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1 An early version of the content of this appendix was presented at the International Conference on the Emotional Power of Music, Geneva, June 2009.
itself, which constitutes the starting point of any reproductive enterprise. I do not know if the expression ‘absolute music’—which refuses the descriptive character a composition may have—is a founded one, but, surely, when the composer’s image is transduced into music it becomes really another thing, even when he aims to reproduce a natural phenomenon. Rightly it has been reported that Beethoven had “always a picture in mind” when he was composing (Knight 2006), but, when he wrote remarks on the score upon his Pastoral symphony, he reminded the oboe section that music is not painting. On the other hand, as D.B. Knight recalls, even R. Schumann denied having natural phenomena in mind when composing, though he gave some of his compositions titles referring to nature. All this lets open the door to the hypothesis according to which the pictures composers have in mind, though they could be related to some sense experience, are of a totally new stuff, namely strictly musical (Knight, p. 42).

In the field of technology, from a methodological point of view, anyone who wishes to reproduce a natural object or process—be it, say, a flower, an arm, intelligence, or the sense of smell—cannot but establish a model of the entity to be reproduced. After all, the concept of model absorbs and generalizes that of image.

Even in operational terms, the concept of model or of image clearly establishes that any reproduction is not a mere two-phase process—not simply the observation of the world followed straightforwardly by its reproduction. On the contrary, there is a third, decisive, intermediate phase, which is that of modelization.

It is necessary to remember that a model is, in turn, the result of a complicated process which, beginning with the interaction with an object or phenomenon, leads to its description according to some observation level. As a logical consequence, a model will allow—and, indeed, will impose—the description of the observed object only through categories and properties that are compatible and consistent with the particularity of the adopted observation level. For instance, the description of a tree from a mechanical observation level will bring to the foreground features that differ greatly from those brought forward when adopting, say, a biochemical observation level.

A work of art is always something ‘other’ than the natural object, not only because of the recourse to materials that are different from those that nature adopts, but also, and perhaps even more so, precisely because nature is already literally transduced into the image, thereby becoming a different reality which appears strongly reduced and polarized when compared to the natural exemplar, owing to the adoption of a certain observation level. This is true even when the composer does not observe, or cannot observe, directly what he wants to reproduce and draws the exemplar from an external account, as in the case of The Creation by F.J. Haydn that follows the description of the Creation in the Bible. The same has occurred in many other cases and also in the history of painting, of course. Anyway, what we hear and what we see are not storms or floods but the image of them in the composer’s mind.

Nevertheless, in the third phase of the reproduction process, which includes the actual reproduction, the recourse to concrete factors, such as matter and energy, will bring the work back into the real world, assigning to it its own high-level
materiality, whose complexity may, at times, match, or perhaps even exceed, that of the exemplar on which it is based.

The illusory character of a work of art, as underlined by Susanne Langer (1953), for example, is only a sensible correlate of art conceived as a reproductive enterprise. It is a sort of residual extension, inherent in the work of art, of the sense experience of the artist, which, after being processed within the image, remains, in greater or lesser measure, in the final product, without having any aesthetical relevance in itself.

We might say that the extra-musical content is intended to reproduce, not an illusion, but rather an allusion to existential or natural factors that become immediately surpassed by, and recomposed in, the artistic composition. This is why, for me, Ottorino Respighi’s introduction of recorded birdsong into his Pini di Roma is particularly instructive, in that the definite separation between the natural phenomenon, in its original form, and the accompanying music, clearly indicates the distance between the sense experience and the artistic reproduction.

In this regard, an interesting analogy holds good for the technological reproduction of natural exemplars. In fact, even technological naturoids, as we have seen, aim to “cheat the body”, because whatever the context within which the naturoid is placed, it has to be persuaded to have to deal with a natural device. In fact, the parts of the body that receive the blood pumped by an artificial heart are interested, so to speak, only in a haematological observation level and nothing else.

Of course, the fruition of a work of art—be it pictorial, musical or whatever—is not aimed at cheating an organism in order to get some special response from it, even if the history of art is not lacking in examples of descriptivism which seek to involve people in various realistic ways. Beyond figurative painting, with its various religious or secular objectives, we need think only of theater scenography, or the numerous trompe l’œils, or, in music, not only the descriptive tradition, but also the deliberate onomatopoeics. Among the most important examples we find The Four Seasons by A. Vivaldi, the twelve pieces The Seasons, for piano, by P.I. Tchaikovsky, The Moldavian by B. Smetana, Musical Portrait of Nature by J.H. Knecht, the concertos The Hunt, The Night and The Goldfinch by Vivaldi, The Sea-Storm by I.J. Holzbauer, the famous pieces for harpsichord Les papillons, Le moucheron, Le rossignol en amour by F. Couperin, and the pieces by P. Rameau Le rappel des oiseaux, La poule. Other noteworthy examples include Symphony No. 6, The Pastoral by L. van Beethoven, The Fountains of Rome and The Pine Trees of Rome by O. Respighi, who also wrote The Birds, a suite for small orchestra, Saudades das Selvas Brasileiras and Alvorada na Foresta Tropical by H. Villa-Lobos and the compositions Réveil des oiseaux and Oiseaux exotiques by O. Messiaen. The skillful presentation of naturalistic effects at the beginning of Peter and the Wolf by S. Prokofiev is also famous. Even Johann Sebastian Bach gives us a masterpiece of this kind with the Capriccio in B-flat, “On the departure of a beloved brother” (BWV 992).

The point is that, in the technological reproduction of a natural object, realism is compulsory, even if often very difficult to achieve. In such circumstances, the
illusion, the deception, embedded in a naturoid is intentionally pursued in order to
allow some performance in a given natural context, which is always ready to reject
that which is not homogeneous to it.

In bioengineering, the deceit is omnipresent almost by definition, and is
welcome, of course. In its more advanced projects, as in the field of artificial
organs, for instance, it clearly exhibits this tendency.

We may also refer to the huge quantity of naturoids designed to fill lacks in
various naturalistic situations, such as artificial nests or artificial reefs, destined to
support biological species whose survival would otherwise be endangered. In such
cases, the illusion, or the deceit, is known to the designer, but goes almost
unnoticed by the natural system involved, as long as such a system assumes the
same observation level as that of the designer. I say ‘almost unknown’ because,
unfortunately, nature is not so easy to cheat, and, sooner or later, in many cases, it
will discover the extraneousness of the artificial, and present the bill, so to speak,
usually in the form of rejection or unforeseen side effects.

As a result of these unplanned outcomes, the technology of naturoids so often
proves unsatisfying, and perceives the inefficacy of the deceit as a failure of the
models themselves.

Regarding these themes, I have defined as ‘transfiguration’ of natural exemplars
the inevitable difference that any artificial device exhibits with respect to the
natural instance. One might say that technological research, though not always,
pursues the minimization of such transfiguration, and intends to proceed in exactly
this direction, even if the goal always moves ahead as it is approached.

By contrast, art follows a different direction in an opposite direction, as it has no
actual benchmark to exceed within natural reality. The image generated by the
artist is always, so to speak, precise and complete, because the artist has nobody to
deceive, although the deceit is technically possible, and, in some historical eras,
has been intentionally pursued in the form of the above-mentioned onomatopoeic
experiences.

In other words, the fidelity of the image with respect to the natural exemplar is
not the artist’s true objective. Rather, he or she seeks to reprocess the sense data
according to his own poetics; that is to say, by producing a deliberate
transfiguration of the exemplar. In this regard, Gustav Mahler provides, in my
opinion, a clear and almost conclusive pearl of wisdom when he states that “If a
composer could say what he had to say in words, he would not bother trying to say
it in music.”

In fact, in order to communicate an emotion—i.e., in order to make it common
to my mind and someone else’s—adopting a musical language would amount to
taking the most difficult, winding and often misleading road. Not by chance does
the understanding of the possible extra-musical content of a non-onomatopoeic
composition, particularly when it has no explicit title, and even if accompanied by
words, almost always requires very complex analysis. Such would be the case for
Franz Schubert’s Lieder, for example, or for the reconstruction of pictorial
affinities in Paintings at an Exhibition by Modest Mussorgsky.
We may set up an analysis which exploits a sort of ‘reverse engineering’ aimed at revealing the natural phenomena that may be embedded in the music. But this is an operation that leads ineluctably to the separation of the two levels, the musical and the natural, in the tacit—and, in my view, unfounded—conviction that the beauty of music becomes amplified by the recognition of its possible naturalistic substrate.

Perhaps flying in the face of common belief, I maintain that Igor Stravinsky was right when he declared “For its own nature, music cannot explain anything: neither emotions nor points of view; neither feelings nor natural phenomena. It can explain only itself.”

**The Rarefaction of Meaning**

We may summarize the above discussion as follows. If one assumes the centrality of the concept of reproduction of mental models or images in communication, art and music, then one must confront the issue of observation levels, because any model is strongly affected by the choice of such a level. This conclusion is taken as a matter of fact in every area of the technology of naturoids.

The objective of any reproduction process, be it in the field of technology or of communication, consists in the achievement of the highest possible level of realism. This means that the reproduced object or process should be as faithful a copy as possible of the exemplar.

This objective is pursued not only through suitable technologies or languages, but also, and above all, by reducing the holistic reality of the natural object to the form of a phenomenology polarized around a dominant profile or level of observation. Nevertheless, the resulting reproduction never amounts to an actual replication, as this is prevented not only by the adoption of different materials and procedures than the natural ones, but also by the selection of one only observation level at a time, from among the infinity of possible levels characterizing the ontology of any natural phenomenon.

The transfiguration—that is to say, the discrepancy between the properties of the natural object and those of the artificial one—assumes, in the world of machines, the form of malfunctions or side effects, while in the world of communication phenomena it takes the form of equivocations, improper mental associations, and sometimes almost complete lack of understanding. This breakdown of effective communication is rendered all the more probable when a large number of interlocutors do not share compatible observation levels regarding the topic under discussion.

However, if we turn our attention from ordinary communication to art, we may ascertain that the reproductive objective of the artist, which actually exists, and which leads to expression, does not concern the sense content of his human experience, but, rather, the image of the experience generated within his or her mind. In other words, in the technological field the model constitutes a tool
constantly in need of empirical, and, so to speak, external verification, whereas in art the image constitutes the originating exemplar, i.e., the reality that is to be reproduced. In some measure transfiguration happens also in our everyday communication since, whenever we build a message by means of the “linguistic technology” available, we stop the building process when the message appears to us as able to reproduce our mental state in a sufficient measure. Really, we are the first listeners of ourselves and this is why our inability to sometimes express ourselves leads us to make statements like “I do not know how to tell you”, “I have no words” or “more clearly than that.” This is a situation that the Italian dramatist L. Pirandello sums up well when he declares that

in the passage from one mind to another, modifications are inevitable … it rarely happens that a writer is pleased that his work, for a critic or for a reader, remains that same work, or thereabouts, that he expressed, and not another, ill-considered and arbitrarily reproduced (Pirandello 1908)

More markedly, the artist also will stop his work when it will seem to him as close as possible to his own image of the world and not when he feels that everyone can recognize what is represented, as technologists or communicating people do.

A technological naturoid comes from the objective observation of a natural exemplar, and aims at its reproduction in equally objective terms, in such a way that it might be recognized, in its essential performance, as a partial or complete reproduction of the original. To achieve this, designers must limit the transfiguration effect as far as possible. Thus, for example, an artificial heart must exhibit at least some of the characteristics and essential performances of a natural heart.

By contrast, a work of art, even when it starts from a naturalistic objective observation, not only does not fear the transfiguration, but even tends to assume it as the main objective, in accordance with the aesthetic vision of the artist. The ambiguity of every work of art, or the opening towards alternate interpretations, is also based on this objective. To put it differently, while technological reproduction and ordinary communication tend towards convergence of result and sensible reality, a work of art generates divergence; and this explains why, as Massimo Mila has written,

We accept the Debussy of Gieseking and that of Cortot, the Chopin of Paderewski and that of Rubinstein, the Beethoven of Furtwängler and that of Toscanini (Mila 2001)

Therefore, the transfiguration of an empirical, sensible reality occurs just at the moment of the formation of the images of the world, exactly as if the artist, in experiencing the world, assumed an observation level already dominated by his aesthetical orientation. This seems to be consistent with, among other things, Levi-Strauss’s remark concerning the opposition between myth and music, according to which the former is free from the sound but is linked to the sense, while the latter is free from the sense but is linked to the sound. Similarly, Boris de Schloezier maintains that music, thanks to the overlapping of signifier and signified, has no sense because it is a sense (Fubini 1995).

The ambiguity and the multiplicity present in the work of art are not the sign of a failed reproduction but, rather, the result of the image of the sense reality arising
in the artist’s mind after having adopted a *sui generis* observation level. It is a matter of an observation level that acts as if it were a new, culturally established sense organ added to the natural set, and this explains why the appreciation of a musical piece, not by chance, needs several, accurate listenings and induces different interpretations.

This musical observation level, as we might call it, is so powerful that it can allow the composition or appreciation of music even in the absence of sounds, or, as in the case of Ludwig van Beethoven, when one has a progressively weakening sense of hearing.

Furthermore, the allusion to naturalistic elements can even produce moments of collision or interference with the strictly musical objectives of the composer, as happened in the case of the ‘damned bird’ which interfered with Antonin Dvorak’s work at Spillville. Dvorak reproduced the bird’s singing, but by means of expressive modalities that were much more than pure imitation, of course.

The transfiguration due to the observation level appears all the more clearly in the case of non-onomatopoeic music, however, because the recognition, by a typical member of the public, of the natural exemplar (be it the sunset, the waves of the sea, a landscape or an emotion) is almost always impossible, even if he is able to grasp the expressive power of the composition, thus ensuring the flow of at least something from the author to the listener.

In painting, where the representational tradition has been much more intense and lasting, we can speak, likewise, of a pictorial observation level, but the so-called ‘rendering’ of a work almost always consists in the transfiguration of at least a sufficiently recognizable core. Music, in turn—perhaps because it is formulated in a language that has little to do with the world of meanings, and that is centred more on the form, and therefore on syntax, rather than on ‘translating’ the author’s emotions—constitutes its own observation levels from the outset, and presents them in terms of an irreducibly musical emotionality. Adopting a rather forced analogy, we might say that, if music were painting, it would surely be, in the vast majority of cases, abstract painting; or at least it would appear as such if the listener claimed to recognize the reproduction of elements of shared sense experience. As has been correctly said,

> … musical descriptions function much more like descriptive nonrepresentational paintings than like representational paintings. In short, music can *describe* but only rarely *represents* the world (Robinson 1987).

We need add only that the fruition itself of music generates emotions, of course, but that the deepest emotions intervene when the listener also succeeds in placing himself at a strictly musical observation level, neglecting the extra-musical effects linked to certain aspects of his own personality, or to situations or memories associated with past listening.
Regarding this point, there is a strong controversy between the cognitivist and emotivist schools of thought, and I cannot but agree with Jenefer Robinson when she observes that the emotions aroused in me are not the emotions expressed by the music (Robinson 1994).

However, the difference is only a presumed one, as it cannot directly be verified at all, and any position in this regard must count on the strength of the theoretical argumentation, or on some kind of mental experiment.

Let us take an imaginary situation, which we could name the ‘crying Korean.’ I do not know the Korean language, but let us imagine that I meet a young Korean who is crying, holding his face with his hands, uttering phrases with an evidently sad and woeful pitch. Although I cannot understand the nature of his pain, surely I shall experience feelings of compassion. Yet my feelings and his will be completely different. In the same way, the emotional effects of music develop even if the composer and the listener do not share the same observation level. For this reason too, therefore, the effects of music should not be confused with its most genuine appreciation.

Anyway, it should be remembered that the emergence of peculiar observation levels, or of ‘senses’ which add themselves to the physiological ones, is not an isolated fact, present only in the arts. The mathematical or geometrical observation of the world, for example, constitutes a dramatic human construction, which, from Pythagoras to Mandelbrot, has made available a profile of reality that goes beyond our usual way of looking at things. The same might be said for the systemic or informational visions of the empirical world. They are true cultural inventions that do not overlap the special ‘optics’ of the theoretical–experimental sciences. These sciences, indeed, along with the observation levels that they imply (e.g., the physical or the biological, the psychological or the ecological), deal with empirical reality assumed as datum, while the intentionally built levels I have referred to, including the musical one, transcribe reality by means of their own, literally invented, grammar and syntax, offering themselves as additional instruments for describing the world, or for its poetical transfiguration.

However, it should be admitted that, in the analysis proposed here, the aptitude of music to construct, in the composer’s mind, its own observation level is the result of a logical deduction on my part, and not yet of an experimental verification. The sequence of my assertions may be synthesized as follows. It forms a sort of pyramid as a metaphor of the incremental loss of ordinary sense and of the parallel increment of specific sense in the transition from communication to art, and from art to music.

Any form of communication consists of a reproduction of mental states, and therefore generates artificial states—i.e., so-called messages. Successful communication is possible only when the receiver of a message places himself at the same observation level as its sender.

Art is a kind of communication, and thus it also generates artificial objects, although they are, to a greater or lesser extent, intentionally transfigured on the
basis of the image the artists builds in himself on his own observation level. On the other hand, at least in the case of figurative art, anyone who enjoys a work of art is sufficiently able to share the observation level of the author exactly because the artificially reproduced sense references usually remain recognizable.

Music, in its turn, is surely a kind of art, and therefore, too, a kind of communication, but the observation level of the author is not easily isolatable and sharable. Indeed, in the final ‘naturoid’ generated by the music, the references to the sense experience, even if often indicated explicitly in the titles, widely escape our perception.

Nevertheless, there is no doubt that the composer lives in the sense reality, drawing from it mental states and emotions that he then seeks to reproduce musically. The fact that we cannot easily recognize the sense references in the final artwork means, therefore, that the composer resorts to a non-ordinary observation level that may be defined as intrinsically musical.

At this point, it could be interesting to consider the following quotations, assuming them as quasi-empirical support concerning the nature of musical composition. For the most part, they are very well known, but, in the context of the present discussion, they may perhaps exhibit a special flavor, because, beyond their rhetorical character, they reveal some of the elements (signalled in boldface type) that I have introduced here in a purely theoretical way. The translations, where they have proved necessary, and in boldface, are mine.

**Statements by Writers or Scholars in the Humanities**

It is worth noting the insistence on the concepts of ‘invisibility’ and of ‘alterity’ assigned to what music expresses. Nevertheless, according to the perspective developed above, music produces what is perfectly visible to the composer at his own observation level. The alterity itself of the musically described world is such only for the observation modalities that music makes possible. It is a level that is accessible, at least partially, to whoever possesses not only a necessary sensitivity to this kind of art, but also sufficient notational, instrumental and orchestral competence.

In the end, other philosophers and scientists, such as Henri Bergson and Albert Einstein, were right when they said, respectively, that “The eye sees only what the mind is prepared to comprehend” and “We see the world through our theories.”

Leonardo da Vinci: “The poet ranks far below the painter in the representation of **visible things**, and far below the musician in that of **invisible things**.”

D. Diderot: “Painting is a more natural art, whereas music is an art very much more **linked to man**.”

V. Hugo: “Music expresses **that which cannot be said** and on which it is impossible to be silent.”

L. Tolstoy: “Music is the shorthand of emotion.”
H.C. Andersen: “Where words fail, music speaks.”

V. de Laprade: “It is undeniable that music induces in us a sense of the infinite and the contemplation of the invisible.”

E. Sapir: “[Music represents] a more difficult mental level, more elusive than expression itself.”

J. Blacking: “The Balinese people speak of ‘the other mind’ as a state of being that can be reached through dancing and music.”

A. Huxley “After silence, that which comes nearest to expressing the inexpressible is music.”

Statements by Composers

The theme of alterity arises among composers also. The visibility, on the contrary, assumes the contour of a perception reserved to the composer, who is able, in other words, to observe the world musically.

L. van Beethoven: “Music is the one incorporeal entrance into the higher world of knowledge which comprehends mankind but which mankind cannot comprehend.”

F. Mendelssohn: “Though everything else may appear shallow and repulsive, even the smallest task in music is so absorbing, and carries us so far away from town, country, earth, and all worldly things, that it is truly a blessed gift of God.”

J. Brahms: “[N]ot only do I see distinct themes in my mind’s eye, but they are clothed in the right forms, harmonies, and orchestration.”

I. Stravinsky: “By itself, music cannot explain anything; neither emotions, nor points of view, nor sentiments, nor natural phenomena. It can explain nothing but itself.”

F. Busoni, on Mozart: “His palace is immeasurably great, but he never steps outside the walls. Through the windows of it he sees nature. The window frame is also the frame of nature.”

H. Walcha: “Bach opens a vista to the universe. After experiencing him, people feel there is meaning to life after all.”

On the basis of the above quotations, one could build the following synthetic definition of music. It might seem a sort of joke, but, in the context of our discussion, it assumes a special conceptual flavor.

Music is an art very much linked to man and it deals with the other mind, to which it gives the possibility to get an incorporeal entrance in the contemplation of the invisible, far away from all worldly things, for expressing the inexpressible. Nevertheless, the composer opens a vista, he sees nature and sees distinct themes in his mind’s eye. But the music cannot explain anything: neither emotions, nor points of view, nor sentiments, nor natural phenomena: music speaks at a more elusive and difficult mental level, of what cannot be said by words and mankind cannot comprehend.
Appendix B: Naturoids and Conventional Technology Devices

Generally, the many kinds of artificial devices normally defined as automatisms are excluded. Moreover, some of the objects or processes which are defined here as artificial do not correspond with the definition of naturoid introduced in this book. On the contrary, they constitute the result of a patchwork or recombination of the same materials present in their exemplars.

Some of the devices are reported without the name of their inventors because of their very ancient and diffuse existence or because of their difficult, precise attribution.

Before 1800 (Various Sources)

Artificial cornea (G. Pellier de Quengsy)
Artificial fireworks
Artificial flower
Artificial horizon (J. Elton)
Artificial ice
Artificial insemination (L. Spallanzani)
Artificial irrigation
Artificial island
Artificial lake
Artificial marble
Artificial propagation (agricultural botany)
Artificial rainbow (F. Bacon)
Artificial selection
Artificial writing (J. Gutenberg)
*memoria artificiosa* (Cosmas Rossellius)
*perspectiva artificialis* (L. B. Alberti, P. della Francesca)

**After 1800 (Various Sources)**

Artificial adaptation (J.H. Holland)
Artificial arm (V. Kolff)
Artificial bait
Artificial barrier
Artificial beach
Artificial bells
Artificial blood (R. Naito)
Artificial blood vessel (A. Carrel)
Artificial blue (J. Guimet)
Artificial bone
Artificial brain cell (A. Richter-Dahlfors)
Artificial cardiac pacemaker (J. Hopps)
Artificial cardiac valve (C.A. Hufnagel)
Artificial cavity
Artificial cell (T.M.S. Chang)
Artificial colours (A. Baeyer)
Artificial diamond (P. Williams Bridgman)
Artificial drying
Artificial ear (A. Djourno, C. Eyriès)
Artificial environment
Artificial esophagus (H. Neuhof)
Artificial experts (M.H. Collins)
Artificial extremities
Artificial eye
Artificial fertilizers (J.B. Lawes)
Artificial fibers
Artificial fish (M.S. Triantafyllou)
Artificial flavour
Artificial gelatin
Artificial grass (D. Chaney)
Artificial gravity
Artificial ground
Artificial habitat
Artificial hair
Artificial hand
Artificial hatching
Artificial heart (P. Winchell, W. Kolff, D. Liotta)
Artificial hip (T. Gluck)
Artificial honey
Artificial horizon for airplanes (A. Sperry)
Artificial incubation
Artificial intelligence (M. Minsky, H. Simon et al.)
Artificial island
Artificial ivory (H. Scarton, S. Calabrese)
Artificial joints
Artificial kidney (W. Kolff)
Artificial knee (A. Burstein)
Artificial lake
Artificial landscape
Artificial language
Artificial larynx (J.E. Mackenty)
Artificial leather
Artificial leaf (D. Nocera)
Artificial leaves (S. Winkler)
Artificial life (C.G. Langton)
Artificial ligament
Artificial light (T. Edison)
Artificial limbs
Artificial liver (K. Matsumura, A. Demetriou)
Artificial lung (G. Mortensen)
Artificial milk (J. von Liebig)
Artificial muscle
Artificial musk (A. Baur)
Artificial nail (F. Slack)
Artificial nest
Artificial nerves
Artificial organs
Artificial pancreas
Artificial paradises (C. Baudelaire)
Artificial pearl (M. Koukichi)
Artificial perfume
Artificial plant
Artificial pond
Artificial radioactivity (F. Joliot)
Artificial rain (I. Langmuir, V. Schaefer)
Artificial reality (M. Krueger)
Artificial rearing
Artificial reef
Artificial resin
Artificial respiration
Appendix B: Naturoids and Conventional Technology Devices

Examples of Conventional Technology (Starting from the Sixteenth Century)

Medical thermometer (Santorio, Galileo)
Telescope (Lippershey)
Printed newspaper (Avisa—Relation oder Zeitung)
Barometer (Torricelli)
Pendulum clock (Huygens)
Pressure cooker (Papin)
Steam engine (Savery)
Flying shuttle (Kay)
Electrical capacitor (von Kleist and van Musschenbroek)
Motor vehicle (Cugnot)
Streetcar (Outram)
Centrifugal governor (Watt)
Electrical cell (Volta)
Carbon paper (Wedgwood)
Bicycle (von Drais)
Stethoscope (Laënnec)
Steering wheel (Ackermann)
Piano (Demian)
Electrical engine (Henry)
Relay (Henry)
Revolver (Colt)
Ship propeller (Ericsson)
Fax (Bain)
Vulcanization of rubber (Goodyear)
Telegraph (Morse)
Nitroglycerin (Sobrero)
Saxophone (Sax)
Gyroscope (Foucault)
Elevator (Otis)
Storage battery (Plant)
Linoleum (Walton)
Rotary press (Hoe)
Machine gun (Gatling)
Generator (Pacinotti)
Dynamite (Nobel)
Celluloid (Hyatt)
Compressed air brakes (Westinghouse)
Chewing gum (Semple)
Drill (Morrison)
Telephone (Meucci)
Gramophone recorder (Cros)
Electric lamp (Edison)
Cash register (Ritty)
Cable railway (Olivieri)
Power station (Edison)
Fountain pen (Waterman)
Steam turbine (Parsons)
Linotype (Merenthaler)
Aluminum (Hall and Hiroult)
Straw (Stone)
Tire (Dunlop)
Eiffel Tower (Eiffel)
Electric chair (Brown and Kennelly)
Electromagnetic wave detector (Branly)
Thermos (Dewar)
Reinforced concrete (Hennebique)
Escalator (Reno)
Zipper (Judson)
Sphygmomanometer (Riva-Rocci)
Slot machine (Fey)
Magnetic recorder (Poulsen)
Disk brakes (Lanchester)
Diode (Fleming)
Joystick (Esnault-Pelterie)
Vacuum cleaner (Spengler)
Cellophane (Edwin)
Neon tube (Claude)
Toxic fume suppresser (Frenkel)
Radioactivity counter (Geiger)
Brassière (Jacob)
Pyrex pot (Littleton)
Tank (Swinton)
Mass spectrograph (Aston)
Cement (Dickson)
Electroencephalograph (Berger)
Television (Baird)
Combustible fluid for missiles (Goddard)
Radio compass (Busignies)
Helicopter (D’Ascanio)
Nylon (Carothers)
Lie detector (Keeler)
Instant coffee (Nestlé)
Spray (Kahn)
Jet (von Ohain)
Atomic battery (Fermi)
Ball-point pen (Bíró)
Atomic bomb (Oppenheimer)
Microwave oven (Spencer)
Radial tires (Michelin)
Pinball machine (Mabs)
Transistor (Shockley, Brattain, Bardeen)
Tetra-pack (Rausing)
Solar battery (Pearson)
Optical fiber (Kapany)
Integrated circuit (Kilby)
Hovercraft (Cockerell)
Laser (Maiman)
Tape cassette (Philips)
Crystal liquid monitor (Heilmeier)
Microprocessor (Faggin, Hoff, Mazor)
CAT (Hounsfield)
Modem (Hayes)
Floppy disk (Apple, Tandy)
Compact disk (Philips, Sony)
AFCEA International Press, p. 60 (1988)
Aunger, R.: What’s special about human technology, Camb J Econ 1, 7 (2009)
Balasubramanian, D.: New eyes for old? The Hindu, Adapted from the Convocation Address given at the Elite School of Optometry, Chennai, 5 Sept 1998
Basti, G.: Intentionality and foundations of logic: a new approach to neurocomputation. In:
Bedini, S.A.: The role of automata in the history of technology. Technol Culture 5, 1 (1964)
Boas, F.: Primitive Art. Instituttet for sammenlignende kulturforskning, Oslo (1927)

References


McGowan Center. http://www.upmc.edu/mcgowan/ArtHeart/Project01.htm


Monantheuil de, H.: Quaestiones mechanicae (1517)


Stravinsky, op cit., p. 54


Takimoto Y.: The experimental replacement of a cervical esophageal segment with an artificial prosthesis with the use of collagen matrix and a silicone stent, 6th internet world congress for biomedical sciences, Presentation No. 177 (2000)


Texas Water Resources. Replicating Mother Nat, 18(1) (1992)


