

The advantages and shortcomings of daisyworld philosophy essay



Topic Selected: The advantages and shortcomings of Daisyworld as an analogue for the real earth system. The aim of this paper is to try and establish whether Daisyworld is an appropriate model of the real earth system, to analyse the debate between academics and in turn to discern whether any part of Daisyworld and indeed Gaia hold any merit.

Background :

Daisyworld is a hypothetical model without the presence of greenhouse gases or an atmosphere. Originally consisted of two types of daises - white reflecting light and black absorbing light. Later models introduced additional factors into the environment such as foxes, rabbits and other species. The main purpose of the Daisyworld system was to illustrate the credibility of the Gaia Hypothesis. This proposes all organisms and their surroundings are interconnected to each other, creating a single, regulated system maintaining conditions for life .

The original Daisyworld system was criticised for being both a rigid and narrow focused system. Since then Daisyworld has been reassessed, evolving into a more complex comprehensive system. Instead of the two fixed daisy species, many additional species were introduced including herbivores and carnivores through three tropic levels with common examples being rabbits and foxes. (Rabbits and foxes mentioned twice, possibly remove 2nd reference?)(Lovelock, 2009)

Advantages:

Daisyworld demonstrates a simple analogue system, explaining the basic principle of Gaia and how every process has (causes instead of has) an action or reaction (couplings).

Although Daisyworld can be perceived as lacking evidentiary support, the daisies show symbiosis with their environment, (but) if one species diminishes (and is) unable to survive with environment changes another species can thrive taking its place or 'niche'.

These components within the Daisyworld model can be seen in the earth system, however Daisyworld is often dismissed as a too simplified representation of natural selection.

In response to criticism, Lovelock's paper 'A numerical model of biodiversity' further expands this model by allowing the organism to mutate spontaneously. Lovelock states that both his paper and work conducted by Tim Lenton and Stephan Harding back this theory and this more comprehensive system goes towards explaining the relationship between biodiversity and planet regulation. (Lovelock, 1992)

Furthermore within "The vanishing face of Gaia" Lovelock outlines at least ten predictions that were proposed in Gaia theory in the 1990s (proposed within Gaia theory), that (remove that) of which eight of them have been confirmed or accepted.

(Lovelock, 1992) (wrong ref, should be 2009)

Prediction

Test

Result

Mars is lifeless (1968)

Atmospheric compositional evidence shows lack of disequilibrium

Strong confirmation, Viking mission 1975

That elements are transferred from ocean to land by biogenic gases (1971)

Search for oceanic sources of dimethyl sulphide and methyl iodide

Found 1973

Climate regulation through biologically enhanced rock weathering (1973)

Analysis of ice core data linking temperature and CO₂ abundance

Confirmed 2008, by Zeebe and Caldeira

That Gaia is aged and is not far from the end of its lifespan (1982)

Calculation based on generally accepted solar evolution

Generally accepted

Climate regulation through cloud albedo control linked to algal gas emissions
(1987)

Many tests have been made but the excess of pollution interferes

Probable for southern hemisphere

Oxygen has not varied by more than 5 per cent from 21 per cent for the past 200 million years (1974)

Ice core and sedimentary analysis

Confirmed for up to 1 million years ago

Boreal and tropical forest are part of global climate regulation

Models and direct observation

Generally accepted

Biodiversity a necessary part of climate regulation (1992)

By models but not yet in the natural ecosystems

Jury still out

The current interglacial is an example of systems failure in a physiological sense (1994)

By models only

Undecided

The biological transfer of selenium from the ocean to the land as dimethyl selenide

Direct measurements

Confirmed 2000, Liss

“ The vanishing face of Gaia.” Lovelock, 2009

With eight out of ten predictions made being either confirmed or accepted, (this) means that these predictions must carry enough merit for them to be accepted by other professionals. This in turn helps support the Daisyworld model and Gaia. (maybe remove paragraph, adding at end before table that confirm of predicts support daisyworld)

It has further been stated within the Daisyworld model that as solar luminosity increases, daises would perish with the increasing temperature, however negative feedbacks dampen these perturbations. This can create issues identifying were (where) some characteristics of an organism had originated, (whether) it be through natural selection or something long term such as evolution. This owes support to the claim, that the world is an interlocking system, coping with a complex interlocking system of feedback loops. This in turn can cause difficulty in isolating the original cause and effect. (Lovelock, 1992)

P. Saunders theorised that natural selection was not always the crucial factor in a species evolution. When enviomental change occurs, organisms have the chance (to) respond or not at all. If the system reacts as expected, its a regulated system however this regulation can cease. This can cause catastrophic collapse or a shift to a new state from which recovery is possible depending on the rate of shift.

Daisyworld surmises that there is another factor involved in the systems self regulation other than natural selection called ' collective intellegence'. Even if this is the case, P. Saunders states that natural selection deals with immediate benefit rather than the long term and insuring stability. This however could be seen as were Gaia could have influence. (Saunders, 1994)

Shortcomings:

One of the main criticisms of Gaia and the Daisyworld model is the claim of planetary regulation through ' collective intelligence'. A further shortcoming of the Daisyworld model has been, that the standard model experiences no greenhouse gases, no atmosphere and no clouds and as such is not ' representative' of claims that the environment intelligently " guides/shapes" the planet, a real earth system.

(Kump et al, 2009) .

Furthermore the model uses luminosity in its calculations which is theorized to increase faster than the earth's sun which could lead misinterpretations in data. Furthermore although equilibrium is achievable, in the case of the earth system, periods of equilibrium tend to be briefer and more erratic.

Another criticism is that a permanent change in luminosity would cause daises to increase across the planet, causing increased albedo and reflectance which could cause a runaway effect. Although this can be witnessed on earth, the Daisyworld system presumes something would be triggered to balance the system. (kump et al, 2009)

The most significant criticism from various academics to Lovelock's theory is that it is 'pure conjecture' not supported by documented evidence.

Lovelock refutes this, citing both evidence he published in his book 'the vanishing face of Gaia' and by insisting random patterns aren't coincidental. Instead he insists the planet possesses greater regulatory force through 'collective intelligence' which maintains constant symbiosis between plants, animals and the environment.

Furthermore, Dolittle identifies that when a chemical or physical parameter nearly reaches critical levels, the mechanism initiating parameters to allow it to return back to optimum levels are seldom identified. Furthermore there seems to be a lack of consistent results. (Dolittle, 1981)

An additional shortcoming presented by Richard Dawkins in his work 'the selfish gene' seems to contradict the Daisyworld paradigm. Dawkins states every organism is out for its interests to survive. Through this, there are many individuals that will try different traits to enhance their possible survival and in turn increase the possibility to further the species survival as a whole. The resulting theory is that individuals out for their own benefit try different traits through trial and error, with successful traits incorporated by the species as a whole and so therefore furthering the species existence. (Dawkins, 1982)

Lovelock counters this by insisting that symbiosis occurs to benefit both individuals and the environment simultaneously with the environment influencing the individual.

Dawkins refutes this stating symbiosis is simply a by product of an individual fulfilling its own requirements.

Furthermore Dr. W. F. Doolittle insists behaviour isn't genetically written, that instead accidentally balanced feedback loops occur which are fragile and happen by chance. This however conflicts with Lovelocks theory of 'collective intelligence' it instead concludes that life is reliant on several crucial parameters and not that these parameters are manipulable which is implied by Lovelock. (Doolittle, 1981)

Agreement or debate :

Daisyworld has been challenged and debated by several academics from various fields of study.

Lovelock believed in hindsight naming his theory Gaia, after the greek goddess had a bearing on peoples opinions causing people to reject his theory out of hand and become more resistant. (Lovelock, 2000)

Furthermore Gaia was criticized for being a teleological system with life's existence predetermined. Lovelock refutes this stating that he never stated that planetary self regulation was purposeful or contained foresight. (Lovelock, 2009)

Stephen Jay Gould criticised the theory stating Gaia's mechanisms involved in self - regulating homeostasis havn't been identified. (Gould, 1988)

David Abram however refutes this criticism stating that the mechanisms itself are in fact metaphorical and consequentially Stephen Jay Gould had misinterpreted what Lovelock was trying to demonstrate. (Abram, 1988)

Lovelock reiterates that the connections between various identified mechanisms may never become transparent and this is why the system should be studied in its entirety. He explains his frustration that in other fields this would be accepted as matter of course. (Lovelock, 2000)

Mathematician R. Feynman backed this rationale further stating that “ a lack of explanation to the cause and effect of a theory may never be answered mathematically and it is indeed is inevitable in the progression of a theory, that even if answerable this may take time”. (Lovelock, 2000)

Lovelock insists that Gaias biological feedback mechanisms use a process of systemic Darwinian evolution, with organisms that improve their environment survive and thrive better than those who damage theirs. (Lovelock, 1979)

W. F. Dolittle criticised this stating that nothing in the individuals genome could produce this functionality of intentionally bettering the individuals environment through the feedback process suggested. He therefore refutes Gaia as a scientific theory as the mechanism is unexplained. (Dolittle, 1981)

In Dawkins book “ The Extended Phenotype” he further refutes this stating organism’s are not able to work to a common plan, as foresight and planning would be required. (Dawkins, 1982)

Biologist L. Margulis and co-founder supports the Gaia hypothesis stating " Darwin's grand vision was not wrong, only incomplete". She reiterates Darwin, stating " the primary mechanism for selection is the direct competition between individuals for resources" of which she expresses that this can be restrictive and lead to a ridged approach towards the subject.

She continues by stating that the earth's atmosphere, hydrosphere and lithosphere's composition are controlled around specific points but that these alter with time. This highlights feedback loops raised in Lovelocks theory further supporting his claims of a level of symbiosis or ' collective intelligence'.

Furthermore she states that there is no tendency to preserve habitats and these communities can exist at various degrees of integration. Lovelock also states that although he feels there is a level of symbiosis these fixed points can become tipping points and so therefore no factor is indeed ridged and there is flexibility in the system. This can be seen when a tipping point has be (been) surpassed and the system shifts to a new state. (Margulis, 1999)

Conclusion / interpretation :

There are many criticisms of Lovelocks work involving Daisyworld, one of the most vocal being Richard Dawkins. Dawkins is one of his main critics of his theory of ' collective intelligence' with the biosphere and evolution of the organisms contributing to form a stable planet.

Dawkins instead favours the gene as a unit of selection, in contrast with Lovelock. This approach, however has been criticised as misleading and should instead be described as a unit of evolution.

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Further criticism is that genes, do not exist alone but instead co-operate with each other both within the individual and its environment. Dawkins, however defends his theory stating that genetic recombination and sexual reproduction from a individual genes view sees all other genes as part of its environment.

This view is criticised especially by professionals studying higher levels of selection including D. S. Wilson & Co who state that a gene based approach can not satisfactorily explain all life for example altruism.

Dawkins approach can be perceived as a restricted approach to understanding the earth system and by not analysing the system as whole results can become fractured and misinterpreted.

Furthermore, initially Dawkins did not have any evidence to clarify his theories, he tries to rectify this in his book (which book, ref?). Dawkins states an individual organism is looking out for itself and this is ultimately beneficial for the group.

This is because if you have many individuals evolving individually any advantageous behaviour or physical attributes can be passed on to the group as a whole. Furthermore this means that advantageous behaviour and attributes are passed onto the group quicker.

In conclusion, Lovelock believes that to obtain accurate results we must look at the earth system as a whole this was why he created the Daisyworld model in order to explain the concept of Gaia and to counter criticism towards the theory.

Lovelock stated that Daisyworld was never intended to be comparable to a real earth system, especially as the model didn't have an atmosphere and was basic in its formation. He instead created Daisyworld as he perceived that other academics were misinterpreting Gaia and its function and so Daisyworld should simply be a means of explaining the processes on earth and how everything is interconnected.

Lovelock confirmed this by stating that Daisyworld was " a cybernetic proof of the Gaia hypothesis" (Kirchner, 2003)

Lovelock argued that other theories for example climate change involve a level of uncertainty and as such is widely understood as a young field of research where inaccuracies can occur without the theory, being dismissed out of hand. Lovelock states his frustration to this, that Gaia and the Daisyworld model are not afforded the same grace.

It is seen in the original model that it was reductional, lacked variability and seemed to have limited comparability to the real earth system. However, this model has extended to include increased species diversity and variability and has included the additional parameters to allow organisms to spontaneously mutate. With these additions, this increases variability into the system which increases the system's credibility by producing more accurate results than the original system. This style of progression can be seen within climate change modeling, where better understanding and increased variability into the system, create a more accurate model moving forward. This however, takes time and as understanding increases so will the model evolve with it.

Support for Daisyworld model, highlights the inclusive whole system approach in contrast to some scientists which views can be perceived by some as reductionist, bottom up approach for example Richard Dawkins. It should be appreciated that Daisyworld and more importantly Gaia is trying to create an inclusive model.

Furthermore some academics have misinterpreted Daisyworld as the theory and have included some of Daisyworlds shortcomings when evaluating Gaia. Instead, Daisyworld should be seen as just a way of explaining Gaia.

Although there are some inaccuracies and shortcomings of Gaia, the theory has already demonstrated that it can evolve over time and as such inaccuracies should be addressed

The Gaia hypothesis has seen eight out of ten predictions confirmed or accepted, some have taken time to be proven for example the biological transfer of selenium from the ocean to the land, this was confirmed in 2000, 21 years after the Gaia hypothesis was formulated. This indicates that with some factors have been proven, others will take time to be confirmed.

Another advantage of the system is that natural selection is accepted by all academics with the field but it has been realised that natural selection may not answer all outcomings. Therefore it is suggested that Gaia would be evolved in the long term and insuring stability.

There are, however some factors that have the possibility of creating miscalculations for example the use of luminosity, which is suspected to be increasing faster than our sun which may lead to misinterpretations. One

further, debated shortcoming is that equilibrium is achievable and that when a runaway effect is caused a balance is expected to come into force. In the real earth system equilibrium can be achievable but it is possible that it would be harder to detect in a real earth system for example for a brief period. There are still issues when a chemical or physical parameter is nearly reached, with the mechanism initialising parameters to return to normal seldom identified.

The Daisyworld Para-dime isn't inherently wrong. The general principle of the Daisyworld Para-dime is a reasonable proposition. The belief that the world regulates itself on a global scale less so. Instead it is more reasonable to expect the small interactions between species, the environment and so on to balance the system. To illustrate, if the amount of Daisies increase the amount of rabbits one be expected (the opposite would be expected) to as well, cause and effect. Lovelocks general theory that when investigating the environmental effect on the planet, in order to get accurate results it should when ever possible be research in a multi disciplined co-operative approach in order to obtain both correct results and to obtain a fuller picture.

Lovelocks theory of planetary regulation is correct but it is seen from the the individual species level, for example if the amount of individual cows increase, the level of methane that these cows produce will increase the levels in the atmosphere which could increase the level of warming of the planet.

Daisyworld is a simplified representation model consisting of many connections, however how these components interact together is hard to

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calculate with an infinite amount of variables. It is possible to make a calculated assumption on how the earth will evolve but this is a ever developing topic with greater understanding increasing over time. For now I can only present my conclusion of whether Daisyworld is a flawed system and whether the method carries any merit when explaining how earth develops over time.

Daisyworld (the planet) has the capacity to remain stable even with components that fluctuate and organism becoming extinct, thus meaning that the small componets can change even though the planet stays the same as a whole. However due to the nature Daisyworld it only has a limited capacity of modelling & prediction. Daisyworld is a basic model to attempt to explain some of the fundamental interactions in a earth focused system, it however lacks detail. We can, however see a more sophisticated & detailed version of the kind of processes that can be seen in the Daisyworld system in modem climate change models. These climate change models are calculated by sophisticated computers which it has been stated that even with this level of sophistication it would still require both a great deal of space and time in order to calculate all eventual probabilities (get the number)

In Lovelock's most recent book ' The revenge of Gaia' Lovelock states that ' Gaia' is finding it increasingly difficult to minimise impact experiencing bigger losses than before, to the rainforest's, planetary diversity and this is testing its ability to minimize the effects off additional greenhouse gases and increases the probability of homeostatic positive feedback associated with global warming. This new stance from Lovelock seems that he is trying to express that the balance that we once had is now being lost. This means that <https://assignbuster.com/the-advantages-and-shortcomings-of-daisyworld-philosophy-essay/>

in the real earth system the greenhouse effect in Daisyworld terms would give a positive radiative forcing effect. This isn't modelled within Daisyworld, as Daisyworld has no atmosphere the planet would be considerably warmer with an atmosphere than without.

The earth system is a dynamic system that changes over time which holds widespread agreement amongst the scientific community, this in itself means that we will always discover new facts about the planet and this will always be evolving.

My assessment.

there is a feed back between the daisies and the environment that helps regulation. the main fault with daisyworld is that the environment consciously adjusts this is instead a reaction to what's happening at a lower level. i don't believe this is what Lovelock is trying to say instead this has been misconstrued as such. we can see that fluctuation has always happened and that the planet, as a whole has been able to regulate itself. the earth however has been less able to do this in recent years, this also has been true in history when there have been tipping points where the earth has not been able to regulate itself or maintain a level state.

in my opinion, trying to be objective, i believe that the factors in which Lovelock used may not exactly be correct or appropriate for example the use of luminosity and the planet having no atmosphere. however, i do firmly believe that Lovelock's work has been dismissed by a section of individuals because of these shortcomings within the daisyworld model. Lovelock to his credit, has clearly stated on numerous occasions that daisyworld is not the <https://assignbuster.com/the-advantages-and-shortcomings-of-daisyworld-philosophy-essay/>

the theory and as such should not be representative of a real earth system and was instead designed to simply explain the gaia theory. i do feel that lovelocks downfall was the fact that daisyworld was lacking in the detail and that this should have been looked at further before publicising.

My conclusion is that daisyworld should not be directly used to calculate the real earth system, as it was never designed to do this. However, daisyworld is a perfect illustration of the gaia hypothesis and works efficiently to illustrate the principles of gaia. It should be used as a aid in order to learn the theory. Gaia, itself seems to be gaining increasing merit but along with climate change modelling, there is an understanding that modeling will evolve in time and i believe this is the same with gaia.