The Optimal Nose

JOHN OHALA, MARC ETTLINGER
University of California, Berkeley

0. In Which We Introduce the Subject

Optimality Theory (OT; Prince & Smolensky 1993) proposes that the structure of language can be understood as communication systems subject to universal constraints and that the differences between languages are due to these voilable constraints being differently rank ordered.

There is precedent for applying the idea of optimality to domains besides language structure, however. One of these is the structure, placement and functioning of the parts of the human body. One such application was made by Dr. Pangloss.[1] In his own words (well, translated, from http://www.literature.org/authors/voltaire/candide/):

> "It is demonstrable," said he, "that things cannot be otherwise than as they are; for as all things have been created for some end, they must necessarily be created for the best end. Observe, for instance, the nose is formed for spectacles, therefore we wear spectacles. The legs are visibly designed for stockings, accordingly we wear stockings. Stones were made to be hewn and to construct castles, therefore My Lord has a magnificent castle; for the greatest baron in the province ought to be the best lodged. Swine were intended to be eaten, therefore we eat pork all the year round: and they, who assert that everything is right, do not express themselves correctly; they should say that everything is best." (Voltaire 1759)

Pangloss's hypothesis, that nature optimizes itself to idealize the system, has been referred to as the Panglossian paradigm (Gould & Lewontin 1979).

From this humble beginning, inspired perhaps by Leibnitzian philosophy, we can see before us a vast field where OT can be used to account for whatever it is that we find in nature, be it language structure or anatomical structure or social structure. In this paper, which is offered as an exercise in the application of OT to human anatomy, of all of the possibilities available, we pick the nose, just as Voltaire did. We propose to explain the structure, placement and function of the human nose and the adjacent nasal cavity as the

[1] Although we could find no original work by this Dr. Pangloss, there is an account of his thinking in Voltaire's Candide (1759)

satisfaction of constraints. The aim is not so much to understand how our nose didn't end up perched on our foreheads or two feet long - this would require serious true scientific inquiry - but rather to model the shape and placement of the nose in a popular contemporary formalism that is both popular and formal.

1. In which We Discuss Picking the Nose

Of the myriad components of our human anatomy, an obvious question may be: Why do we pick our nose? The reason we pick our nose is as plain as the… well, very obvious. The nose has multiple functions to satisfy, as detailed below, and yet it has to do so with a single structure. Also, it must interact with other parts of the anatomy, such as the larynx, which has its own set of constraints as dictated by yet other functions, e.g. eating and drinking. The result is that some functions are accommodated better than others; in other words, some functions outrank others. Given its familiarity, as opposed to, say, the spleen, the nose presents itself as an ideal subject of analysis. After our survey and discussion of the functions of the nose, we will offer a formalism that allows for the rank ordering of these functionally derived constraints outputing the **optimal nose**.

1.1 In Which We Review Previous Uses of the Concept of Optimality

We would be overstating our originality if we suggested that this is the first application of optimality theory outside of the realm linguistics. There are several such cases, further substantiating optimality theory's optimalness for describing the Universe.

A celebrated example is Dresher's (1996) historical survey. He cites the prioritization of Biblical commandments as the first attested example of Optimality Theory being used as a way of resolving competing demands. This precedent lends significant credence to this theoretical approach – Jews tend to be right about such things.

Subsequent applications of OT to the world beyond linguistics are found in the literary analyses of Macaulay (2001) and Kiparsky (2005). Macaulay (2001) shows how the hair color of the protagonist in detective stories is the optimal resolution of constraints on shortness, tangledness and redness, while Kiparsky (2005) has suggested that an input of a banana can still yield the correct meter in English folk songs.

Perhaps the application of optimality most analogous to our own can be found in the paper that gave the Panglossian paradigm its name (the "-ian paradigm" part, not the "Pangloss" part which is credited to Voltaire), Gould and Lewontin's 1979 paper "The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme." Therein, Gould *et. al*. argue that the adaptionist programme (it clearly has a Middle English origin), which is the evolutionary biology equivalent of optimality theory, is, well, worthless.

Ye Adaptioniste Programme requires that every product of evolution be the result of nature's drive towards achieving an optimal organism; each individual trait must be optimal for some purpose. Thus, the diminutive front legs of a Tyrannosaurus Rex must be as short as they are for some optimal reason, independent of phyletic heritage (read as:

independent of some set of historical changes). The reason Adaptionistas were forced to come up with is that its purpose was to "titillate females" (Gould *et. al.* 1979; p. 1). In our experience, short appendages have never achieved such a feat.

Any instances of non-optimality in a particular system must be described as optimal in some other part of the system. "Trade-offs among competing selective demands exert the only brake upon perfection; nonoptimality is thereby rendered as a result of adaptation as well." (Gould *et. al.* 1979; p. 12)

The idea of constraint ranking clearly has scholarly credence. The analogy to linguistics should be transparent: Every characteristic of a phonological system must be the optimal resolution of some set of constraints. History doesn't matter so much as achieving some optimal balance between universal faithfulness and markedness constraints.

Never mind Gould & Lewontin's damning criticism of this approach. The important thing to realize is that the idea of looking for optimality in the organization of systems has significant cross-discipline precedent.

2. In Which We Discuss the Functions of the Nose

To begin our OT analysis of the placement and character of the nose, we list those functions of the nose, both external and internal, that we have found to be important in our daily lives:

1. A place to rest eyeglasses.
2. Ingesting certain substances including, e.g., cocaine and other medicines.
3. Breathing.
4. Smelling and taste.
5. Speech: essential for the production of nasal consonants and nasalized vowels.
6. Equalizing the pressure around the ear drums (via the Eustachian tubes)
7. Serving as the destination for excess tears (via the so-called tear ducts)
8. Decoration
9. Physical displays of affection for others by 'rubbing noses'
10. The introduction of medical and scientific instruments that view or sample relevant physiological parameters in the pharynx, trachea, esophagus and other organs that these structures lead to.
11. Young children are known to use the nose as a place to stuff small objects, e.g., beans, small toys. We call this function 'exploratory storage'.
12. The external appearance of the nose helps determine identity and appearance.
13. The nose has a role in facial expressions, i.e., non-verbal communication. Like the mouth its external appearance can be modified to an extent by surface muscles.
14. The paranasal sinuses, six cavities in the head, have an unknown function but among various speculations are that they reduce the weight of the skull or that they serve as resonators to modify auditory feedback.

15. Metaphors (e.g., ‘to keep one’s nose to the grindstone’) and deictic self-reference.

We will now elaborate on the above functions and discuss the degree of success the nose has in satisfying them. In particular, our interest is in the interaction and competition between nasal functions; to the extent that the satisfaction of given function suffers due to inherent constraints or competition with other functions, we conclude that it is lower ranked.

2.1 Functions of the Nose: Breathing

Although the nose, technically the nostrils and nasal cavity, are undeniably involved in the necessary function of breathing, it should be noted that the mouth is also used for this purpose but with some limitations. Three reasons make the nose ideal for breathing over the mouth.

First, many times it is necessary to have the mouth closed or otherwise occupied (e.g., while eating and drinking or kissing) when it is still necessary to breathe. Second, the nose also warms, humidifies, and filters the air entering the lungs. These functions are less effective when breathing through the mouth. Third, breathing through the mouth makes one a mouth-breather, and no one wants to be one of those people.

Further evidence for the primacy of the nose over the mouth for breathing comes from newborns. In newborns, the nose is the exclusive passage for breathing, the ability to breathe orally not appearing for a few months. After this stage of what’s called ‘obligate nose breathing’, the nose and the mouth are both available for air input and output but only the nose remains fully open, since, except for velum (soft palate) there are no voluntarily operable valves in the nasal cavity.

Having mentioned the factors which elevate the nose and nasal passages for the function of breathing we must also take into consideration certain factors which render these passages less than favorable for breathing.

In spite of our sharing the Panglossian philosophy that everything that is, is for the best, one cannot but be somewhat unhappy with the design of the input channel to the human lungs: it is the same as the output channel, leading to the result that one cannot have a continuous supply of life-giving air. This necessitates ‘time-sharing’ of the one channel, alternating between inspiration and expiration -- and, furthermore, makes the lungs a place for dirt and pathogens to accumulate and promote pulmonic disease.

Wouldn’t it have been better to have separate output channel so that periodically one could flush the system (as is the case with the alimentary canal)? But maybe we should not go into what would be involved if **that** system used the same channel for input and output.

If the nose is irritated or if larger-than-normal foreign objects invade it, more than the usual amounts of mucus are produced giving rise to a “runny nose” or a “stuffed nose”. This impacts negatively on some of the other functions of the nose. This might be considered a design defect, but clearly it’s snot.

Another unfortunate aspect of the design of the air intake channel is that it has to share the passage – the pharynx -- with the alimentary canal. Food and drink taken in through the mouth passes through the pharynx on its way to the esophagus, the opening to the stomach and the intestines beyond. Occasionally, air or food and drink end up going into the wrong channel. It is not a big problem when air goes into the esophagus, as it often does: when this air is so displaced it exits back through the esophagus producing a belch. But, it is a problem when food or drink enters the larynx and trachea. The lungs are not designed to accommodate any input other than oxygen-rich air.

One might think that the potential problem of food or drink entering the lungs is solved by two devices: first, the elaborate mechanism of swallowing which involves moving the larynx forward and upward at the same time as the tongue releases its charge into the pharynx, and, second, the larynx acting as an extremely effective defense against incursions of unwanted substances. So effective is this sphincteric trap that if the invading substance is not immediately coughed out, the larynx closes around the object preventing its further movement but also – in many cases – causing the person to choke to death. That outcome might not seem so optimal but then maybe death is preferable to having unwanted material in the lungs. Who is to make this evaluation without actually experiencing both outcomes?

There are anatomical designs that would avoid this unfortunate mixing of the respiratory pathway and alimentary canal. As mentioned above, newborns have the breathing passage mostly shielded from the channel through which food passes (since their epiglottis overlaps the velum). Cetaceans (whales, dolphins, porpoises) have a tubular structure called the ‘goose beak’, an extension of the epiglottis, which fits into the nasal passage which exits at the blowhole on top of their head. The respiratory channel is thus completely isolated from the alimentary canal. However, as is well known, cetaceans do not wear eyeglasses. We can conclude, then, that the function of wearing eyeglasses outranks the function of breathing in humans.

2.2. Functions of the Nose: Smelling

There are some 4000 differentiable smells. Even so, humans rely less on their sense of smell than, apparently, other mammals, e.g., dogs. This, supposedly because of human’s upright posture puts them further from the ground where a great many scents are to be found. But further evidence that smell is a secondary function in humans is that it is so variable. Smell sensitivity fluctuates in women during menstruation and pregnancy and in everyone when they have a cold that involves a congested nasal cavity and with advanced age. In some cases people voluntarily restrict the sense of smell by pinching their nostrils shut, e.g., when in lavatories, eating durian, or embracing certain linguistic theories.

2.3. Functions of the Nose: Speech

The nose also serves the purpose of making distinctively nasal vowels and nasal consonants. But clearly the parts of the human body used for speech are not optimized for

exploitation of nasals: There are places of articulation (anything further back than the uvula) for which nasal-oral coupling has no effect—thus there are no pharyngeal or glottal nasals comparable to labial and velar nasals. It is also known that as a class, nasal consonants are highly confusable – and thus the incidence of place assimilation (assimilation to following consonants) is greater with nasals than with other manners of oral consonants. Also, although nasal(ized) sounds are abundant in the world's languages, there are some languages that reportedly have no nasal sounds, (Wichita, Rood 1975; Pawnee, Parks 1976). Universal phonological patterns also testify to the "2nd class" function of nasal sounds: In general there are fewer distinctive places of articulation in nasal consonants vis-à-vis oral consonants and there are never more nasal than oral vowels and often, as in French, less. Therefore, the ranking of this function of the nose for speech must very low.

2.4. Functions of the Nose: Ingesting

Because of the thinness of the mucous membranes over the dense carpet of blood vessels in the surfaces of the nasal cavity, nasal injection is commonly used to administer certain medicines and drugs. The injected substances reach the bloodstream quicker. This is used not only for anti-histamines where the target is the nasal mucosa but also when other bodily organs are the target, e.g., the kidneys (Minirin, a cure for bedwetting). It is reported that in shamanistic rituals among the Yanomami of the Amazon certain hallucinogenic substances are injected into the nose of participants via a blowpipe wielded by the shaman. Other psychoactive substances such as snuff and cocaine are ingested nasally. The fact that long-term such use of the nose can depress the sense of smell is evidence that the function of nasal ingestion ranks higher than the function of using the nose for smelling.

2.5. Functions of the Nose: Equalizing the pressure in the ear drum

The ear is a pressure transducer. For hearing it must transduce frequencies within the range 16 Hz to (if possible) 20 kHz or more. These are the so-called AC frequencies. The ability of the ear to accurately transduce such frequencies is diminished if in addition lower frequencies, esp. DC, are superimposed on the AC frequencies. One side, of course, is exposed to the atmosphere, the other side vents via the Eustachian tubes to the nasal cavity. This arrangement works well to neutralize the low frequencies allowing just the high frequencies to be detected. But unfortunately the Eustachian tubes often are closed, either due to the presence of mucus or because of a chronic condition whereby the tubes simply collapse. In either case it makes for an unpleasant experience when flying or diving, i.e., into atmospheres that have an ambient pressure different from that at ground level. Clearly this is a sub-optimal design. Why couldn't the vent on the other side of the ear drum have been placed somewhere where it wouldn't get clogged by mucus? In fact, in cases of chronic collapse of the Eustachian tubes, the standard surgical solution is to make a small hole in part of the ear drum itself – the part that does not have the inner ear

on the other side.[2] Apparently, this 'fix' works well and usually restores normal hearing. Why couldn't a design of this sort been worked out from the start?

2.6. Functions of the Nose: Tears' Runoff

There is no question that eyes need the lubrication of tears and that they normally get an adequate supply from the lachrymal glands. But the rationale for having tears drain into the nose escapes us. The result is that when a person cries and there is an excess of tears, this has the side effect of increasing watery discharge from the nose – commonly known as 'the sniffles' after the rapid pulmonic ingressive gesture aimed to limit the discharge through the nostrils. Nevertheless, the fact that this excess of tears impacts negatively on breathing and smelling indicates that it ranks higher than them.

2.7. Decoration

Depending on the culture, one can find tattoos, scarification, piercings and other decorations on the nose. On the plus side, this is a site where the decoration is most likely to be seen and noticed by others. On the minus side, the nose does not offer the tattoo or scarification artist as large a 'palette' as do other parts of the body. Also, although decorative objects on the ear lobes may dangle, nose piercings typically do not dangle. The reason obviously is that they would obstruct entrance of food and drink into the mouth. There is an exception to this. There is a form of jewelry worn especially by Asian Indian brides (during the wedding ceremony) that involves a dangling nath, as it is called, that is also connected to one ear. This does interfere with eating and drinking and requires the wearer to lift the dangling part away from the mouth. Had our concern been with the relative ranking of the function of nasal decoration and eating, this would provide evidence that the function of eating is lower ranked. But, we are not concerned with functions of the mouth. Another more relevant constraint is that the objects attached to the nose be not so large as to block the free flow of air in and out of the nostrils. This motivates a lower ranking of this decorative function than that of eating and breathing.

2.8. Functions of the Nose: Kissing

Individuals from Alaska to New Zealand show affection by touching noses. For this purpose it is convenient that the nose sticks out, that is, projects from the plane of the face: it allows a show of intimacy without the contact becoming too intimate or, as in the case with lip kissing, an opportunity for exchange of potentially disease-causing pathogens. Nose kissing can be done simultaneously with most other functions such as smelling, breathing, and supporting eyeglasses.[3]

---

[2] The present design of the ear which has the pressure normalization accomplished by the Eustachian tubes suffers from the inevitable result of assigning too many functions to the same basic apparatus. The nose and nasal cavity are already overburdened with other functions.

[3] From this point of view, kissing on the lips is somewhat unnatural and has some negative effects – spreading germs, smudging lipstick, not being able to see the kissee during the kiss, etc. It is said that lips-

2.9. Functions of the Nose: Experimentation

The nose + nasal passage + pharynx is the favored route for various instruments having medical or scientific import: Within phonetics, the nasal route has been used for measuring buccal pressure, sub-glottal pressure (using a thin tube with an inflated condom in the esophagus), the glottograph, the nasograph, the velo-graph, and fiber-optic probes that provide images of the glottis and of the tongue. (With further probing, we could probably find a half-dozen other instruments introduced via the nose.) Within medicine, the nasal route is preferred for tubes that either introduce or extract substances into the stomach (via the esophagus). The same route has been used for certain probes into the lungs and, for that matter, devices which need access to the tear ducts or Eustachian tubes. Of course, we phoneticians wish the opening were larger so that a wider variety of instruments could be inserted, but we suppose that can't be helped. A wider nasal passage would conflict with the functions of smelling, filtering, warming, and humidifying the air, etc.

2.10. Functions of the Nose: Eyeglasses

Perhaps the most crucial function of the nose is to provide a resting place for one's glasses. What is most striking about this function is that the nose evolved its current shape well before eyeglasses were invented. One tenet of OT is that the constraint set is universal so historic changes are reflected in the re- ranking of constraint and not by newly introduced constraints. Therefore, this constraint had to have always been there, so in early homo-erectus this was simply a low ranked constraint and a million years later, received a higher ranking.[4]

2.11. Functions of the Nose: Metaphor and Deixis

The nose is serves as the focal point for a number of linguistic expressions, including a number of metaphors and for deictic reference.

Metaphoric examples include:

(1) Keep your nose clean.
(2) Brown-nose.
(3) Blue nose.
(4) Nose in the air.
(5) A nose for news.
(6) Plain as the nose on your face.
(7) Stick one's nose in other people's business.
(8) Pay through the nose.
(9) On the nose...
(10) To thumb one's nose ..

---

to-lips kissing arose as a kind of intimate gesture mimicking the act of mothers (in non-Pablum, non-Gerber's cultures) of passing food that they had masticated to their just-weaned but toothless children.

[4] What foresight!

(11) To have one's nose in the air
(12) Nosey
(13) Keep one's nose to the grindstone
(14) To have one's nose bent out of joint

Also, if you are also thinking that pointing to the nose is a way to indicate the truth value of an utterance, you're absolutely right.

3. Placement and Structure

In addition to the above functions of the nose we need to give some attention to the overall placement and structure of the nose.

For many of the functions, one might consider whether the nose and connected nasal passage could be placed anywhere else except in the middle and front of the face. Breathing and smelling would permit lower placement on the body, say, nearer the lungs. However, most of the other functions, including, especially, resting the eyeglasses and draining the eyes of excess tears require placement near the eyes. Although the placement of the nose in cetaceans is ingenious, allowing them to breathe when just their upper surface breaks the water – and the complete separation of the respiratory and alimentary passages, one must allow that they will never be able to wear eyeglasses.

One aspect of the nose that seems, on the face of it, to be ill-designed, is that it sticks out from the plane of the face. It is thus more likely to be injured in a fall and it is more likely to get damaged in a fight. It doesn't help matters that it has a somewhat fragile cartilaginous support in the way it is attached to the skull. Comparing the human nose to the noses of our close anthropoid cousins, the orangutan, gorilla and chimpanzee, we see that our noses are the only ones of this branch that protrude. These negative functions of the nose reflect a constraint against it sticking out so as to be struck.

The observation that the nose does protrude in humans clearly demonstrates the strength of our theory. For species that don't wear glasses, the constraint is ranked lower. This suggests that their noses will be flat. The predication made by the theory holds: Because chimpanzees don't wear glasses, their noses are flat.

Extending this to babies, we clearly see that they do not wear glasses either. And indeed, babies have cute button noses which also facilitates passage through the birth canal.

As the child begins to read and require glasses and is no longer making trips through the birth canal, the nose begins to protrude. As sight begins to degrade in older people, we see larger and larger noses. This change in the morphology of the nose is the correlate of the functions of the nose changing, which re-ranks the constraints in the formalism. So, again, we see the predictive power of the theory.

4. Formalization of Functions as Constraints

With the functions of the nose laid bare, it is now necessary to articulate some of the theoretical underpinning of Optimality Theory as used for the features of the nose. The reader is directed to the voluminous literature on OT for the basics of its implementation for Phonology. There are a number of parallels between anatomical OT and Phonological OT.

Just as with Phonological representations, there is an underlying and surface form of the nose. Whereas piercing changes the surface form, a nose job (i.e. cosmetic surgery) changes the underlying form. The underlying form serves as input to an evaluative system that outputs the surface form based on the constraint ranking. Since the constraints alone are supposed to represent the generalizations on nose shape, the underlying form is necessarily unconstrained. In Phonology, this is called richness of the base; for anatomy, we propose a richness of the face.

Another requirement is that the constraints be 100% grounded and cannot be simply added to the system as needed – except when it's really really needed to get the whole thing to work out right. This represents a constraint on constraints. Constraints on constraints will be discussed further in a future paper where we propose a set of constraints on constraints on constraints, but it's worth highlighting an example here.

One constraint on constraints is that all constraints must make use of Latin or Greek letters to represent variables. Another is the aforementioned constraint that constraints be grounded. Based on these two constraints on constraints, we can now explore the constraints on constraints on constraints: The fact that these two constraints are both in English represents a constraint on constraints on constraints.

4.1 Constraints on the Nose

Given the functions above, we can now articulate a set of formal constrains for the nose. A small subset will be included here to demonstrate how Nose OT (NOT) works.

The requirement that the nose be used for breathing is represented by the constraint BREATHE which incurs a violation if the placement of the nose inhibits breathing.

The requirement that the nose be shaped so as to avoid being hit is represented by the constraint *STRUCK which incurs a violation if the placement of the nose leads to possible interference with flying objects.

The requirement that the nose support glasses is enforced with a MAX-SEE constraint, maximizing the ability to see.

The requirement that the nose not complicate the birthing process is enforced by an constraint aligning the nose with the birth canal, ALIGN(BIRTHCANAL).

MAX-IO requires that everything that goes in the nose, must come out.

The requirement that the nose allow for the identification of the owner is enforced by the constraint IDENT(OWNER).

Being able to play the nose flute is enforced by a constraint on nasal harmony, HARMONY(Nasal).

Finally, the constraint on the nose being ideal for decoration is a paralinguistic constraint, outside the set of basic linguistic functions. Therefore, this constraint is referred to as PARA-DECORATION, abbreviated PARA-D.

4.2 Tableaux

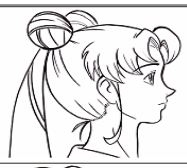
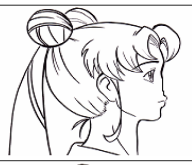
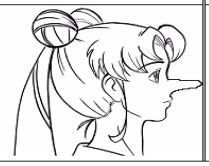
With the constraints formalized we can now give a few examples of the optimization of the surface form of the nose.

The first tableaux demonstrates the constraints on nose placement:

	Breathe	Max-See
(a)☞ 		*
(b) 	*!	
(c) 		**!

The position is determined by the ranking of BREATHE >> MAX-SEE. It is more important to be able to breathe than support glasses. The result is that the nose is lower than would be ideal to prevent slippage.

The next tableaux shows the relevant constraints for nose size:

	Max-See	*Struck
(a)☞ 		*
(b) 	*!	
(c) 		**!

Because being able to see is more important than not getting hit (MAX-SEE >> *STRUCK) the nose protrudes enough to support glasses, but not so much that it would break when walking into walls.

The next tableaux shows that the need to prevent germs outranks the requirement that the nose facilitate breathing, play the nose flute or be used to signal affection:

	*Germs	Breathe	Harmony	Affection
a. ☞ 		*!	*!	*!
b. 	*!			

The relevant ranking is *GERMS >> BREATHE, HARMONY(NASAL), AFFECTION.

4.2 Factorial Typology

One of the great successes of OT has been the idea that the factorial ranking of constraints should correspond to a linguistic typology; that each possible ranking of constraints should result in a different attested language.

For example, the variable ranking of faithfulness, coda and onset constraints give, as possible basic syllable structures (C)V, CV(C), CV and (C)V(C), excluding VC.

In our example, the same success is to be found in re-ranking the constraints to get the placement and shape of the nose for different species.

Demoting MAX-SEE in the case of chimpanzees, who don't read, gives a ranking of *STRUCK >> MAX-SEE. The result is a flat nose, inappropriate for glasses, but less likely to get hit. This is precisely the nose we see on chimps.

In wolves, where sense of smell is crucial, the constraint MAX-SMELL outranks *STRUCK. The output result is the long snout found on wolves.

Finally, for dolphins, who live in the water, a *DROWN constraint is ranked above MAX-SEE placing the nostrils at the top of the head.

5. Deflecting Criticism

We are aware of several criticisms that have been leveled at Optimality Theory. These criticisms, we assert, are all unfounded.

First is the suggestion that OT is completely ad hoc; that constraints proliferate like randy rabbits (but are nowhere near as cute). Clearly, this criticism stems from not realizing how important OT is to finding jobs and getting tenure.

Second is the criticism that in the end, OT reduces to nothing more than a description of the patterns of a language and that it explains nothing. This criticism is also invalid and as it's simply based on an inability of the critic to find the pointy-finger symbol thingy on the keyboard.

Third has been the assertion that the best argument for OT is that it keeps linguists busy and manages to fool dissertation advisors, journal editors, and granting agencies into thinking that if something uses such arcane formalisms then it must have some value. Had this critic been able to publish any journal articles since the time that SPE rules died off, we're not so sure the criticism would still have been made.

Finally, there is the damning criticism that OT resembles Ptolemaic cosmology in the freedom with which novel patches can be introduced to save appearances; that nothing empirical, whether phonetic, psychological, or socio-historical, is required. Being non-testable, it therefore has a status similar to literary criticism or the making up of fairy stories rather than to science. Or to provide another analogy, that OT modeling resembles mathematic curve-fitting where adding new constraints is like adding additional terms to a series just to get an equation that better fits the curve. This criticism falls within the domain of other criticisms that make the analogy between linguistics and hard sciences like physics or chemistry. It isn't so much a criticism as it is a sign of science envy or, in those theories where statistics are important and real causative effects are evaluated by their *p* (for probability) level, a sign of *p*-ness envy.

What refutes all of these criticisms is the fact that such a vast amount of work (or perhaps only half-vast) has been done within the OT framework and we cannot simply throw it all into the dustbin of failed linguistics theories, can we? Well, can we?!?

References

Dresher, Elan. 1996. The Rise of Optimality Theory in First Century Palestine. *Glot International* 2, 1/2, p. 8.

Gould, Stephen Jay and Richard C. Lewontin. 1979. The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme. *Proc. Roy. Soc. London B* **205** pp. 581-598.

Kiparsky, Paul. 2005. Where Stochastic OT fails: a discrete model of metrical variation. Q&A period of presentation at 31st Annual Meeting of the Berkeley Linguistics Society.

Macaulay, Monica. 2001. OT as a Predictor of All Human Behavior: The Case of the Red-Headed Detective. *MILC 4 Program*.
Parks, Douglas R. 1976. *A grammar of Pawnee*. New York: Garland.
Prince, Alan and Paul Smolensky. 1993. *Optimality Theory: Constraint Interaction in Generative Grammar.* Rutgers University Center for Cognitive Science Technical Report **2**.
Rood, David S. 1975. The Implications of Wichita Phonology. *Language* 51:315-337.
Voltaire (François-Marie Arouet). 1950 [1759]. *Candide*. Translated and edited by John Butt. New York: Penguin Classics.

John Ohala
1203 Dwinelle Hall
Berkeley, CA 94720 U.S.A.

ohala@berkeley.edu

Marc Ettlinger
1203 Dwinelle Hall
Berkeley. CA 94720, U.S.A.

marc@berkeley.edu