Time travel in Harry Potter – an Optimality Theoretic account

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"We solemnly swear that we are up to no good."
- password for accessing the Marauder's Map

The plot device of time travel is a very common phenomenon across literature*. In many cases, the application of time travel renders the story apparently internally-inconsistent, requiring the reader to perform drastic repair strategies in order to process the meaning. Remarkably, readers nearly always interpret a plot involving time travel in the same way. It is clear that universal principles of interpretation are involved. To our knowledge, this phenomenon has not been satisfactorily explained by any theory of literature or temporal physics. In this paper, we will demonstrate that time travel is best analyzed by Optimality Theory (Prince and Smolensky 1993). The data that we discuss come primarily from Rowling's (1999) *Harry Potter and the Prisoner of Azkaban*, but we believe that our analysis of this particular case of time travel can extend to other novels as well.

1. The data

In *Harry Potter and the Prisoner of Azkaban* (henceforth HPPA), the strategy of time travel is used to repair the storyline, which otherwise would undesirably contain innocent deaths and injustice being dealt to the protagonists, a highly marked structure that is rarely attested in children's literature. Some background on HPPA and a brief summary of the relevant section of the story is given below. The data is slightly simplified for the sake of exposition; for complete details consult Rowling (1999).

In Hogwart's School of Wizardry and Witchcraft, the groundkeeper Hagrid's hippogriff is sentenced to death on false charges. Meanwhile, Sirius Black, an alleged murderer and godfather to Harry Potter, the protagonist, has escaped from the prison of Azkaban and is on the loose in search of Harry. The relevant section begins as Harry and his good friend Hermione walking back to the school from Hagrid's house, just before the execution of the hippogriff is to take place. They are sidetracked through a secret passage to the Screaming Shack, where they encounter Sirius Black, Remus Lupin, a teacher at Hogwart's, and Peter Pettigrew, who was the real criminal of the crime Black was convicted for. There they learn of the innocence of Black, and of the real account of Harry's parents' death. Then Severus Snape, another teacher at Hogwart's who bears an old grudge against Black and Lupin, enters the Shack and threatens to turn Black in to the authorities. The protagonists successfully capture Snape and Pettigrew, and are going back to the school when they are waylaid by some Dementors, the unearthly creatures who guard Azkaban. The only creature that can counter a Dementor is a Patronus, but only Lupin has enough power to summon one, and he was unfortunately turned into a werewolf; and so Harry and Hermione are left to their own devices. Harry tries to summon a Patronus and fails. Surprisingly a Patronus far more powerful than what he has previously been capable of summoning appears and drives off the Dementors.

The party is then found unconscious by the authorities, who recapture Black. Harry and Hermione attempt to convince the authorities of Black's innocence, but

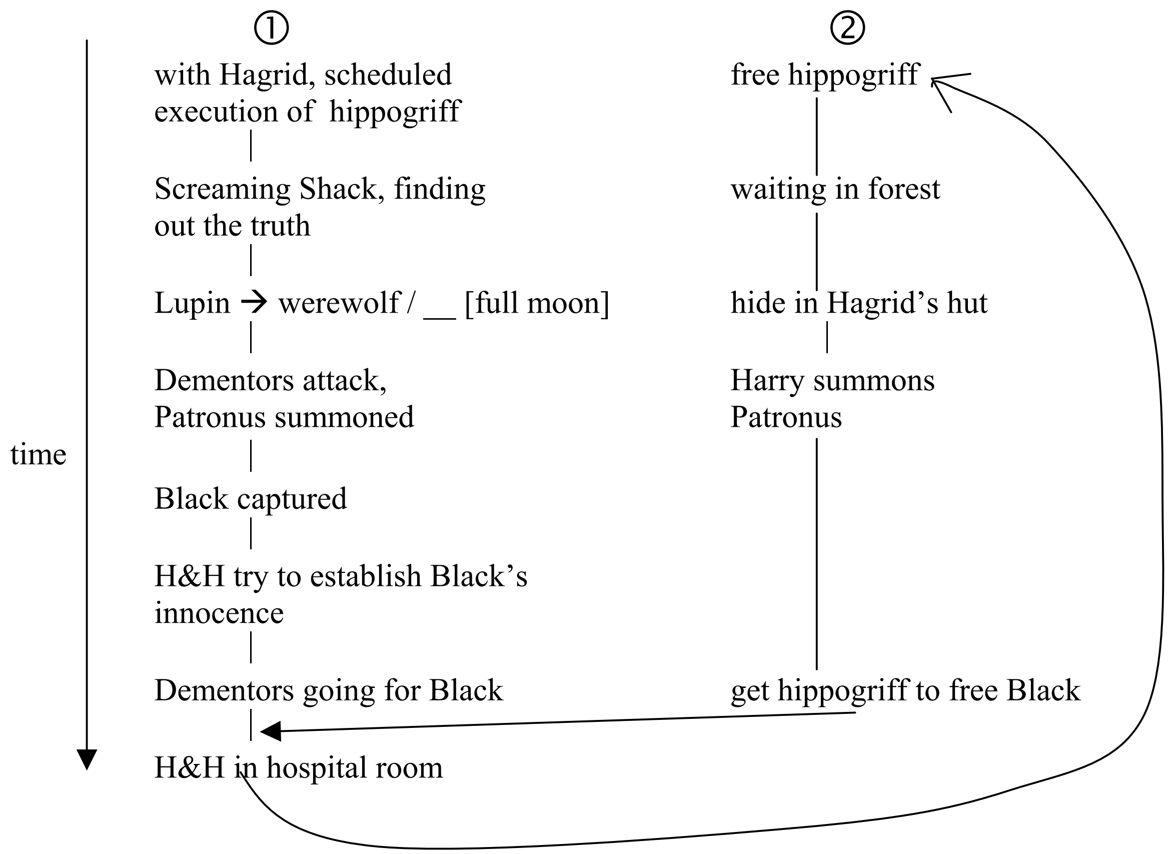
* The authors' names are in alphabetical order. We are grateful for insightful discussions with each other. We would also like to thank one anonymous librarian at the Santa Cruz public library, who helped us locate versions of Rowling (1999) in French, German, and Spanish, thus facilitating our cross-linguistic research. Any remaining mistakes or inconsistencies are other people's fault.

without avail; they are confined to the hospital ward. The Dementors are called in to execute Black, when Dumbledore, the headmaster of the school, instructs Harry and Hermione to use magic to go back in time, in order to save both the hippogriff and Black.

Harry and Hermione then go back in time, to the time right before they went to Hagrid's house. This time, instead of going to Hagrid, they free the hippogriff while no one is watching. Then they take the hippogriff to hide in the forest, but when the time comes when Lupin is to turn into a werewolf, Harry and Hermione return to Hagrid's hut to avoid meeting him. After a while, Harry, remembering the mysterious appearance of the powerful Patronus, decides to go see what happens. Sure enough, he sees the first instances of himself, Hermione, and company emerge from the secret passage and be attacked by Dementors. In desperation to help the first instance of himself, seeing that there s no one else to help them, he tries to conjure a Patronus, realizing that he must be the one who conjured the powerful Patronus. After he saves the first instance of the characters, he returns to Hermione. They wait until Black is taken hostage again, then they fly to the school on the hippogriff, rescue Black, who rides away on the hippogriff, and then they go back to the hospital again.

A diagram summarizing the data is as follows; the vertical axis shows the progression of time in the story, and the arrows show Harry and Hermione's experience.

(1)



Looking at this diagram, it is clear that a linear derivational account simply cannot account for the data. It runs into at least the three following problems:

(2) Problems with a derivational account

i. If travelling back in time occurs in the environment of H&H being in the hospital room, our protagonists would become entangled in an infinite loop; this is the famous "infinite regress" problem.

ii. There is no underlying representation for the Patronus. Since Harry, not even two of him, could summon such a powerful Patronus, no reordering of rules can derive the Patronus in the forest scene.

iii. There are two of Harry and Hermione in this section, at the same time. This seems to be a violation of physical laws. A derivational account cannot explain why this violation is possible here, and cannot constrain the environment where this process occurs. Also, it cannot ensure that Harry and Hermione return to the exact same place as they left, at the right time.

It thus seems that a non-derivational account of this phenomenon is called for. In the next section we will discuss what a possible Optimality Theoretic account should look like, and in section 3 we argue that Sympathy theory (McCarthy 1998) is required to pick the correct output. Section 4 argues for a Positional Faithfulness account of constraining reduplication of characters over a Positional Markedness account, and section 5 deals with the very interesting effect of "The Emergence of the Patronus" (TEP). In section 6 we discuss characterial strata effects. The theoretical implications of our analysis will be summed up in section 7.

2. An approximation of an analysis

In extending a theory of grammar to literature, we need to first clarify what some terminology means in the new setting. The input to the evaluation machinery is a set of features, containing characters, settings, and plots, which the author has in mind to put in the novel. The candidate generator in the author's mind, then, generates all possible storylines given the input material. The "infinite candidate set" problem is avoided as many candidates, or, storylines, that are too boring, will be harmonically bounded by others that better satisfy ***BORING**, which is undominated[1]. These potential storylines are then evaluated by a set of ranked constraints, presumably universal in literature. The ranking of the constraints is fixed for the particular author in question; thus, although the Richness of the Base (and the author's imagination) will allow any combination of story elements, the outputs (i.e. the published novels) often share the same characteristics. Take "Protagonist is bullied at home" as an input, for example. In three of Rowling's works including HPPA, this theme occurs in the beginning of the book. This suggests that for Rowling, **ALIGN-BEGINNING("BULLY", BOOK)** is high-ranked, higher than constraints such as **INMEDIASRES**, which requires a narrative to start in the middle of the action, and which is highly ranked in other literature such as Anglo-Saxon epics.

[1] This is true at least for the majority of published fiction. We make no claims about unpublished manuscripts.

(3) Tableau for the beginning of the first three Harry Potter novels

/protagonist bullied at home/	ALIGN-B("BULLY", BOOK)	INMEDIASRES
☞a. Harry bullied at home in the beginning		*
b. Harry bullied at home in the end	*!	

In (3), the input is an unordered set of events, and the output is an ordered sequence of those events. This will account for simple plots, but is not sufficient to account for plots involving time travel. Consider the diagram in (1): if we try to generate this plotline with a tableau like the one in (3), we may be able to order the events correctly with respect to the passage of time, but we will have no way to distinguish between the events that Harry and Hermione experienced first (the events in column 1) from those that they experienced second (the events in column 2). We need a way to refer to the order in which each character experiences the events of the story, as well as the order in which the events occur with respect to an objective time scale.

Correspondence Theory (McCarthy & Prince 1995) provides us with a straightforward solution to this problem. Let us assume that the input consists of a set of characters and events, and that the output consists of a tuple of event sequences: one sequence of events in the order that they occurred with respect to an objective time scale, and one sequence of events in the order that they occurred with respect to the experiences of each character. The events in each timeline in a candidate stand in correspondence with the events in the other timelines. This is illustrated in the schematic tableau in (4) below. The first candidate in (4) represents a plot in which neither character undergoes time travel, while in the second candidate Character1 travels in time.

(4) Schematic Tableau for plot generation

/Char1, Char2, Ev1, Ev2/	C1	C2
Obj: E1 E2 Char1: E1 E2 Char2: E1 E2		
Obj: E1 E2 Char1: E2 E1 Char2: E1 E2		

Of course, if we generate a separate timeline for every character, the structures to be evaluated will explode. We take it to be uncontroversial, however, that only major characters undergo time travel; it will therefore only be necessary to generate timelines for a few characters.

Our tableaux will generally be more informal than (4): the candidates will be prose descriptions. We do so only to improve readability; the informal tableaux can always be converted into the formalism introduced in (4).

In such a framework, time travel is best characterized as a violation of **UNIFORMITYOB-Cα** ("no element of the input objective timeline has multiple correspondents in character α's timeline") and **LINEARITYOB-Cα** ("character α's timeline is consistent with the precedence structure of the objective time line, and vice versa."). UNIFORMITY is violated as one or more events appear twice in the relevant characters timeline (or, perhaps more intuitively, because there is more than one instance of each character participating in the time travel in the period of time that they travel to). This is analogous to reduplication. Linearity is violated because at the point when the characters travel back in time, they do not observe the precedence structure of objective time scale. In a sense, their time scales are "metathesized". Normally, these two constraints are highly ranked, to prevent random time-shifting and inconsistent timelines, but here (and in other science-fiction and fantasy novels) they are dominated by yet other constraints, which force time-travel to happen.

Let us take the example of Harry and Hermione travelling back in time to save the hippogriff, for example. If they do not do so, the hippogriff, an innocent creature, would die, in violation of **MAX[INNOCENT]** ("every innocent creature in the input must have a corresponding (non-dead) output"). On the other hand, if they were to save the hippogriff in the first place, they would have to overtly fight the people from the Ministry of Magic who preside at the execution. That would be a violation of ***CLASH**. The only way to solve the problem, then, is to satisfy *CLASH by not confronting the adults in the first time, and satisfy MAX[INNOCENT] by coming back a second time to free the hippogriff, at the expense of UNIFORMITYOB-C:

(5) Tableau for hippogriff-saving-time-travel

/H&H, HG, HGs execution/	***CLASH**	**MAX[INNOCENT]**	**UNIFORMITY**
a. H&H save HG	*!		
b. H&H don't save H		*!	
☞ c. H&H don't save HG the first time, but travel back in time to save			**

There are three other time-travelling options for Harry and Hermione, such as one where the first instance of them (H&H1) saves the hippogriff, but the second one (H&H2) doesn't, or a possibility where neither H&H1 nor H&H2 save the hippogriff, or one where both pairs do. These candidates are harmonically bounded by Candidate C in Tableau 5. This is seen in the tableau below:

(6) Tableau for hippogriff-saving-time-travel 2

/H&H, HG's execution/	*CLASH	MAX[INNOCENT]	UNIFORMITY
a. H&H1 save HG, H&H2 don't	*!		**
b. neither H&H1 or H&H2 save HG		*!	**
c. both H&H1 and H&H2 save HG	*!		**
☞ d. H&H don't save HG the first time, but travel back in time to save it			**

3. Sympathy saves the hippogriff

The analysis in (6) runs into problems when we start considering options where other people travel back in time. For example, what if H&H1 do not save the hippogriff, but Harry travels back in time with *Dumbledore* to save the hippogriff? As each use of the time-travelling magic by underage wizards is a violation of Ministry of Magic laws, denoted by the constraint **LAW**, if Harry were to travel back with Dumbledore the timeline would incur one less violation of LAW. Candidate D in the following tableau, then, is harmonically bounded by any other candidate that involves time travel but fewer violations of the law.

(7) Tableau for hippogriff-saving-time-travel 3

/H&H, HG's execution/	*CLASH	MAX(INNOCENT)	UNIFORMITY	LAW
a. H&H save HG	*!			
b. H&H don't save HG		*!		
☹ c. H&H1 don't save HG, Harry travels back in time with D to save it.			**	*
☞ d. H&H don't save HG the first time, but travel back in time to save it			**	**¡

The only way to solve this problem, and to ensure that our beloved Harry and Hermione are the ones who travel back in time to save their friend the hippogriff, is to invoke Sympathy Theory (McCarthy 1998), which allows a candidate to be faithful to another candidate, chosen by a selector constraint. We propose that the selector constraint here is **UNIFORMITY**, as it is important for the optimal candidate to be maximally similar to another one that does not have strange cases with multiple instances of characters, even if the optimal candidate itself violates it. Looking at the tableau in (7), we can see that both Candidates (a) and (b) satisfy UNIFORMITY, and they tie otherwise (as *CLASH and MAX[INNOCENT] are unranked). This is a favorable result, as we want the output candidate to have H&H *both* save and not save the hippogriff:

(8) Tableau for hippogriff-saving-time-travel 4

/H&H, HG's execution/	*CLASH	MAX [INN]	MAX-❀O	❀UNIFORMITY	LAW
❀ a. H&H save HG	*!				
❀ b. H&H don't save HG		*!			
c. H&H1 don't save HG, Harry travels back in time with D to save it.			*!	**	*
☞ d. H&H don't save HG the first time, but travel back in time to save it				**	**

By appealing to Sympathy, we can elegantly explain why time-travel is necessary in HPPA, and at the same time avoid the infinite regress problem.

4. Positional Faithfulness vs. Positional Markedness

One would expect that there should be high correspondence between the two instances of Harry and of Hermione. As stated, the uniformity violations incurred by Harry and Hermione are cases of reduplication, and as such we expect a high level of correspondence between the two outputs. This holds, except with regard to the characters' positions. Having both Harrys and Hermiones in the same place at the same time is an OCP violation. And therefore we can establish the ranking **OCP** >> **IDENTBR[PLACE]**.

However, it is crucial at the end of the time travel period, that the reduplicant Harry and Hermione return to the same place that they went back in time from. This will prevent others in the story from realizing that a UNIFORMITY violation took place[2]. Therefore, the place of the linearity violation is a strong position: It demands that both Harrys and Hermiones are present at the crucial moment. In HPPA this is the hospital. Thus we have the ranking as in (9).

(9) **IDENTBR[HOSPITAL] >> OCP >> IDENTBR[PLACE]**

This will ensure that markedness wins out over faithfulness in all instances but the one protected by the positional faithfulness constraint, which is ranked higher than OCP.

It is a point of contention in the field as to whether Positional Markedness subsumes Positional Faithfulness (or vice versa) (see Smith 2001 and references therein). Even though this larger question is beyond the scope of this paper, we are interested in examining a possible Positional Markedness account. Reduplication is a marked structure. Therefore, it can only occur at climatic points in a story as there are more pages

2 Others might perceive it as a LINEARITY violation, if they saw Harry and Hermione first in one place, and then without sufficient time, in another place. What others perceive during time travel is an interesting subject that we will not pursue further here as these undesirable effects are minimized in HPPA due to the success of Harry and Hermione2.

("cues") to support the marked structure. A reasonable constraint seems to be **COINCIDE(RED, CLIMAX)** (Zoll 1998), but we have already seen how the UNIFORMITY violation is forced by the highly ranking MAX[INNOCENT] (prohibiting the death of the hippogriff and Black) and *CLASH (prohibiting Harry and Hermione 1 from saving either). Thus we have made both the reduplication, and the timing of it, fall out from other factors. COINCIDE(RED, CLIMAX) doesn't tell us anything about when the two instances of Harry and Hermione must coincide.

Furthermore, a Positional Markedness-based analysis would predict that augmentation in a strong position (climax) would be possible. Potential instances of time travel outside the climax are predicted to be shifted into the climax, surfacing there. Whether this prediction holds is an empirical question.

Thus we see that Positional Faithfulness can achieve the desired output whereas a Positional Markedness account seems to be out of reach.

5. The Emergence of the Patronus

As noted in section 1, the Patronus presents an interesting problem. Its appearance is clearly forced by the high ranking of MAX[INNOCENT], and yet the Patronus is a very marked structure. Harry has, on multiple occasions (including this one: Harry1 attempts and fails to conjure a Patronus before the strong one appears), attempted to conjure a Patronus and the outputs have always been weak, showing the high ranking of *PATRONUS.

The ranking MAX[INNOCENT] >> DEP is clear, as a Patronus is epenthesized in the relevant scene. However, the markedness constraint *PATRONUS can independently be shown to be ranked above MAX[INNOCENT] as Harry1 actually is unable to conjure a Patronus, even in the face of the immediate death of three innocents, including himself. This presents a serious problem: how are we ever to force a Patronus to occur? In the tableau below, we see that the current ranking predicts that no Patronus will ever be conjured.

(10) Patronus tableau

/no patronus/	***PATRONUS**	**MAX[INNOCENT]**	**DEP**
a. conjure patronus	*!		*
☞ b. no patronus		***	

Harry2 is only able to conjure a strong Patronus because he knew he did it before. Again, it must be pointed out that the derivational account would fail here. There would be no possibility for the Patronus to occur while Harry was Harry1, as he would not experience Harry2, which would come about later in the derivation as the result of a later rule application. It is only if Harry1 and Harry2 exist in *parallel* that Harry1 can have access to the conjuring of the Patronus.

This problem can now be sorted out by a anti-metathesis constraint which dictates that Harry experienced the time period involved first as Harry1 and then as Harry2 (although it's crucial to keep in mind that both exist in parallel; see section 2). The constraint which we propose here is **EXPERIENCELINEARITY[KNOWLEDGE]**, which means that Harry must first experience things as Harry1 and then as Harry2 and retain the knowledge of Harry1 when Harry2. Thus, because Harry1 experienced the Patronus being conjured, he retains that knowledge as Harry2. Remember, even though the evaluation proceeds in parallel, Harry's knowledge reflects a linear path.

(11) Harry's conjuring of the Patronus

/no patronus/	**EXPERLIN[KNOWLEDGE]**	***PATRONUS**	**MAX[INNOCENT]**
☞ a. conjure patronus		*!	
b. no patronus	*!		***

Thus we see a clear case of The Emergence of the Patronus (TEP) effect.

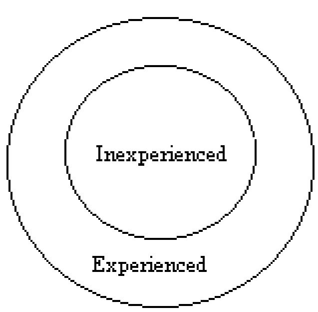
6. Stratum Effects

In the previous section we saw that *PATRONUS must be ranked above MAX[INNOCENT] for Harry, because Harry cannot produce a Patronus even when the lives of innocents are at stake. However, a fully grown wizard such as Lupin is able to produce a Patronus to save innocents. For Lupin, then, *PATRONUS must be ranked below MAX[INNOCENT]. This ranking paradox suggests that Harry and Lupin are in different strata (see Fukazawa et al for discussion on lexical strata). The complete ranking, with MAX[INNOCENT] relativized to the two characterial strata, is shown below.

(12) MAX[INNOCENT]/EXPERIENCED >> *PATRONUS >> MAX[INNOCENT]/INEXPERIENCED >> DEP

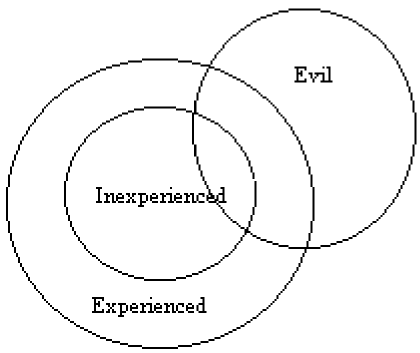
One might wonder whether the structure of the Rowling lexicon (i.e. the characters of HPPA and their associated constraint rankings) is best characterized by the onion model or the artichoke model (see Phonology C class notes for a detailed discussion on these models of stratum effects). At first glance, the experienced and inexperienced characters appear to fit the onion model. The lower ranking of M with respect to the experienced wizards' faithfulness constraints means that the outputs with inexperienced characters will be a subset of the possible outputs with experienced characters. This is demonstrated in (13) below.

(13) The Onion Diagram



However, when we consider evil characters, this picture changes. An evil wizard like [Ø][3] would never conjure a Patronus to save an innocent, suggesting that [Ø] shares the ranking *PATRONUS >> MAX[INNOCENT] with Harry. But in fact [Ø] would never try to save an innocent, whereas Harry would. This shows that the ranking of MAX[INNOCENT] must be lower for [Ø] than for Harry, while [Ø] is more likely than Harry to violate MAX[INNOCENT]. Furthermore, many difficult, or marked, magic spells available to [Ø] are not available to Harry. It's clear, then, that the outputs involving evil magicians are neither a subset nor a superset of the plots with characters from other strata, giving us an artichoke structure, as shown in (14).

(14) The (impressionistic) Artichoke Diagram



Whether the different strata referred to here correspond in any way to social strata is unclear. So far, it seems that what determines the stratum a character is to be put in depends on how long the character has been assimilated into the wizard culture. However, such diachronic effects are hard to measure, and we leave them as an open question for further research.

7. Conclusion

Although many of the constraints we have used to illustrate our tableaux are specific to HPPA, most if not all are able to be generalized to other literature as well. *PATRONUS, for example, represents a not-uncommon fact in literature that there is a marked structure which will drive off an antagonist. (If the structure is not marked, i.e. easily come by, driving off the antagonist is trivial and violates *BORING.) As was pointed out in section 4, IDENTBR[HOSPITAL] marks the point in HPPA where LINEARITY was violated. Although the specific place (hospital) will not hold cross-literaturally, it will very often be the point where LINEARITY was violated that time-traveling characters must stand in identity with their non-time-traveling counterparts. Thus we can see that many of the claims put forth in this paper will hold more generally.

There are, perhaps, a few points in the paper with which could be quibbled. We, as stated, have simplified the data somewhat, but crucially predict that it holds for the entirely faithful situations in the text. If however, it is found that there are problems in so

[3] The reader must reconstruct, due to the highly ranked constraint against saying the name of the most evil wizard in the world.

implementing our proposals, it should be noted that this can only be due to two factors. Either there are errors in the transcription of the data, or there is a production error. Our analysis is so elegant that it must be maintained at all costs.

References

Fukazawa, Haruka, Mafuyu Kitahara, and Mitsuhiko Ota. 1998. Lexical Stratification and Ranking Invariance in Constraint-based Grammars. To appear in the proceedings of the CLS 34.

Kager, René. 1999. *Optimality Theory.* Cambridge University Press.

McCarthy, John, and Alan Prince. 1995. Faithfulness and reduplicative identity. In Jill Beckman, Laura Walsh Dickey, and Suzanne Urbanczyk, eds., *Papers in Optimality Theory* (UMOP 18). Amherst: GLSA. ROA-60.

McCarthy, John. 1998. Sympathy & Phonological Opacity. Ms. University of Massachusetts, Amherst.

Prince, Alan, and Paul Smolensky. 1993. Optimality Theory: constraint interaction in generative grammar. Ms., Rutgers University and University of Colorado, Boulder.

Rowling, J. K. 1999. *Harry Potter and the Prisoner of Azkaban*. New York : Arthur A. Levine Books.

Smith, Jennifer. 2001. Class lectures, Phonology C, UCSC.

Zoll, Cheryl. 1998. Positional asymmetries and licensing. Ms., MIT. ROA #282