On Multiple Sympathy Candidates in Optimality Theory[*]

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1 Introduction

McCarthy (1997, 1998) argues, on the basis of data from Tiberian Hebrew, that Optimality Theory (OT) (Prince and Smolensky 1993, among others) can allow a failed candidate to affect the choice of the actual output: faithfulness relation between the failed candidate and possible candidates is crucial to determining the actual output. Following McCarthy, let us call the failed candidate a "sympathy" candidate (= ❀-ed candidate). He claims that in addition to ordinary IO-Faithfulness constraint, there is a new type of Faithfulness constraint called "Sympathy"-Output Faithfulness (= ❀O-Faithfulness) constraint, which requires that the actual output must be identical with the ❀-ed candidate.[1] Furthermore, McCarthy suggests that (i) some designated IO-Faithfulness constraint be chosen as the "selector" (= C❀), which is relevant to the algorithm for determining the ❀-ed candidate, and that (ii) the ❀-ed candidate obey C❀ that the actual output violates (McCarthy 1997).[2]

In this paper I will pursue the possibility that the notion of sympathy can shed some light on phonological "opacity" (Kiparsky 1971, 1973), assuming that the ideas suggested by McCarthy are basically on the right track. However, even if so, some non-trivial questions arise immediately as to the basic assumptions of sympathy: how can we choose a particular IO-Faith constraint as C❀ to determine the ❀-ed candidate? Why is it that C❀ is restricted to the IO-Faith family of constraints which the actual output violates? Is it the case that the number of ❀-ed candidates is limited to only one? Are "multiple ❀-ed candidates" allowed if every IO-Faith constraint potentially serves as C❀?

I will suggest that every IO-Faith constraint can serve as C❀ regardless of whether or not the actual output violates it. I will argue that "multiple ❀-ed candidates" should be allowed in OT once we assume that every IO-Faith constraint serves as C❀, demonstrating that "multiple ❀-ed candidates" are empirically motivated in certain vocalic alternations in Yawelmani, where various opacity effects are created by the interaction among the vocalic alternations.

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[1] Note that this analysis enables us to say that the ❀-ed candidate can play the role of something like "intermediate stages", although it is not necessarily the same as the "intermediate stage" postulated in rule-based generative phonology. See the discussion in section 4.

[2] In section 3.2 we will discuss the mechanism of sympathy in detail.

Furthermore, I will claim that language variations with respect to opacity effects can be captured by the re-ranking of ❁O-Faith constraints.[3]

The organization of this paper is as follows. In section 2, we deal with basic facts about vocalic alternations in Yawelmani. In section 3, we provide an OT analysis for the vocalic alternations in Yawelmani and demonstrate that the notion of sympathy is indispensable to explain complicated opacity effects generated by counter-bleeding. In section 4, we propose that more than one ❁-ed candidate play very crucial roles in opacity effects in Yawelmani vocalic alternations, suggesting that every language potentially has multiple ❁-ed candidates. Section 5 states some concluding remarks.

2 Vocalic Alternations in Yawelmani: Basic Facts

First of all, let us consider the following examples involving Vowel Harmony (VH), Vowel Lowering (VL) and Vowel Shortening (VS) and examine how they interact with one another to create opacity effects. Following Kenstowicz and Kisseberth (1979), I assume that the rule ordering is specified as follows: after VH, VL occurs. VS takes place after VL.[4,5]

In VH, if the vowels [u] and [o] precede the vowels [i] and [a], respectively, [i] becomes [u] and [a] becomes [o]. (1a) illustrates VH with the high vowel [u]. (1b) indicates that vowels participating in VH must be the same with respect to vowel height. This is what I call the "monotonicity" effect (cf. Cole and Kisseberth 1995).

In VL, long [u:] and [i:] become long [o:] and [e:], respectively. Notice that in (1a), just looking at the relation between the input (= UR) and the output, VH should not apply due to the monotonicity effect, but actually it does. This is a case of counter-bleeding. On the other hand, in (1b), judging from the relation between the input and the output, VH should be expected since both of the vowels relevant to round harmony are [-high] vowels, but VH does not occur. This is a case of counter-feeding.

[3] For more detailed discussion on opacity effects in Yawelmani and the analysis of the multiple sympathy candidates, see Hoshi 1998.

[4] See also Archangeli 1985, Kuroda 1967 and Newman 1944.

[5] The vowel inventory of Yawelmani is assumed to be as follows:

	i	e	a	o	u
high	+	–	–	–	+
low	–	–	+	+	–
round	–	–	–	+	+
back	–	–	+	+	+

(1) VH & VL:

a. (counter-bleeding)

UR:	/ʔu:t'-it/	
VH: i → u /u___	ʔu:t'-**ut**	
VL: u: → o:	ʔ**o:**t'-**ut**	'steal' (passive aorist)

b. (counter-feeding)

UR:	/ʔu:t'-ʔas/	
VH: a → o/o___	------------	
VL: u: → o:	ʔ**o**:t'-ʔas	'steal' (predicative gerundial)

As indicated in (2), VS, which applies after VL, makes long vowels short in closed syllables. Interestingly enough, the example in (2) shows both cases of opacity: VL should not be expected because of VS (= counter-bleeding) while VH should occur because the domain of round harmony is monotonic with respect to vowel height, in this case [-high] (= counter-feeding).

(2) VL & VS: (counter-feeding & counter-bleeding)

UR:	/bok'-i:n/	
VH: i → u/u___	-----------	
VL: i: → e:	bok'-**e**:n	
VS: V: → V/___C]$_\sigma$	bok'-**en**	'will find'

(3) is also a case of counter-bleeding. The difference between (2) and (3) is that in (2) VH does not apply due to the monotonicity effects while in (3) it does.

(3) VH & VL & VS: (counter-bleeding)

UR:	/dub-i:n/	
VH: i → u/u ___	dub-**u:**n	
VL: u: → o:	dub-**o:**n	
VS: V: → V/___C]$_\sigma$	dub-**on**	'will lead by the hand'

3 Opacity Effects and Sympathy in Yawelmani

3.1 Constraints & Canonical Examples

In this section we will see how the above opacity effects can be captured within the framework of OT. As a first approximation, let us assume that the constraints in (4) are relevant to vocalic alternations in Yawelmani. Among Phono-Constraints, *HIGHLONG, *[μμμ]$_\sigma$ and MONO are undominated.[6]

(4) i. Phono-Constraints:

a. *HIGHLONG: Long vowels with [+hi] are prohibited. (Lubowicz 1997)

b. *[μμμ]$_\sigma$: Trimoraic syllables are prohibited.

c. MONO: The domain of round harmony in the output must be monotonic with respect to [± high] (cf. Cole & Kisseberth 1995)

d. ALIGN [+rd]: The [+rd] feature aligns with the right edge of the word. (Prince & Smolensky 1993, McCarthy & Prince 1993a, 1993b, Pulleyblank 1993, 1996)

ii. Faithfulness Constraints:

a. IDENT-IO (hi): [hi] feature in input and output must be identical in corresponding segments.

b. IDENT-IO (rd): [rd] feature in input and output must be identical in corresponding segments.

c. MAX-IO (μ): Deletion of μ is prohibited.

Given the above relevant constraints, let us examine the tableaux in (5i-v). The following canonical examples of vocalic alternations clearly indicate how the constraints work and how they are ranked.

In (5i), *HIGHLONG and MAX-IO (μ) are more dominant than IDENT-IO (hi), and thus the candidate (5ia) is correctly chosen as optimal, excluding both (5ib) and (5ic).

(5) i. Vowel Lowering (VL): *HIGHLONG, MAX-IO (μ) >> IDENT-IO (hi)

/i:/ /u:/	*HIGHLONG	MAX-IO (μ)	IDENT-IO (hi)
a. ☞ e: o:			*
b. i: u:	*!		
c. i u		*!	

(5ii) demonstrates that VS is derived from the constraint-ranking *[μμμ]$_\sigma$ >> MAX-IO (μ). The candidate (5iib) violates undominated *[μμμ]$_\sigma$ and thus it is ruled out. Therefore, (5iia), which satisfies *[μμμ]$_\sigma$, is chosen as the optimal candidate.

ii. Vowel Shortening (VS): *[μμμ]$_\sigma$ >> MAX-IO (μ)

sap-hin 'burn' (non-future)

[6] However, later we will see that MONO is dominated by a "sympathy" constraint.

/sa:p-hin/	$*[\mu\mu\mu]_\sigma$	MAX-IO (μ)
a. ☞ **sap.-hin.**		*
b. **sa:p.-hin.**	*!	

(5iii) shows that VH is induced by the constraint ranking ALIGN [+rd] >> IDENT-IO (rd). Since (5iiia) respects ALIGN [+rd], it is chosen as optimal.

iii. Vowel Harmony (VH): ALIGN [+rd] >> IDENT-IO (rd)
dub-hun 'leads by the hand' (non-future)

/dub-hin/	ALIGN [+rd]	IDENT-IO (rd)
a. ☞ dub-hun		*
b. dub-hin	*!	

However, as we mentioned before, it is not necessarily the case that VH always occurs. MONO has to dominate ALIGN [+rd], otherwise VH would always apply, contrary to fact. The monotonicity effect can be captured by the constraint hierarchy MONO >> ALIGN [+rd]. (5iva) is selected as the optimal candidate because it satisfies MONO. In contrast, (5ivb) violates MONO because of VH and thus it is correctly excluded.

iv. Monotonicity Effect: MONO >> ALIGN [+rd]
dub-al 'might lead by the hand'

/dub-al/	MONO	ALIGN [+rd]
a. ☞ dub-al		*
b. dub-**o**l	*!	

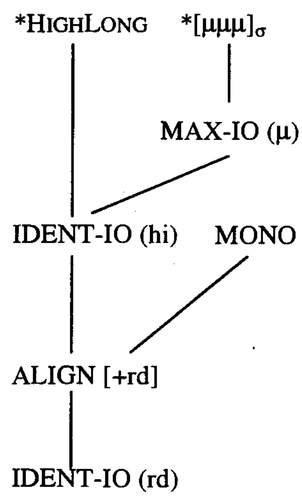
(5v) shows that vowel height cannot be changed freely to satisfy the requirements of both monotonicity and the alignment condition. Assume that IDENT-IO (hi) dominates ALIGN [+rd]. Then, (5va), which satisfies both IDENT-IO (hi) and MONO, is selected as the optimal output.

v. Restriction on vowel height alternation: IDENT-IO (hi) >> ALIGN [+rd]

/dub-al/	IDENT-IO (hi)	MONO	ALIGN [+rd]
a. ☞ dub-al			*
b. dub-**ol**		*!	
c. d**o**b-**ol**	*!		
d. dub-**ul**	*!		

Given the above basic facts, we tentatively assume here that the relevant constraint ranking for Yawelmani vocalic alternations is represented as in (6):

(6)



Keeping this in mind, let us first examine examples with one of the cases of opacity, namely, counter-bleeding, which clearly shows that the basic OT analysis cannot straightforwardly capture the opacity of counter-bleeding interactions.

3.2 Counter-Bleeding and Sympathy

Consider the following example of counter-bleeding (1a). Examine the tableau (7). If the constraint rankings are as in (6), we would wrongly predict that the output is (7a), which does not undergo round harmony, but satisfies MONO (the candidate wrongly chosen as optimal is indicated by ⊗):

(7) tableau based on the constraint-ranking in (6): wrong result[7]
*HIGHLONG >> IDENT-IO (hi), MONO >> ALIGN [+rd]

/ʔu:t'-it/	IDENT-IO (hi)	MONO	ALIGN [+rd]
a. ⊗ ʔo:t'-it	*		*
b. (☞) ʔo:t'-ut	*	*!	

In (7), the actual output (7b) violates MONO, and is wrongly excluded. Since the canonical examples (5iv) and (5v) definitely show that MONO is higher-ranked than ALIGN [+rd], we cannot resort to any re-ranking of the constraint hierarchy given in (6) to obtain the right result for (7). So, the question is how we can capture the opacity example as well as the simple canonical examples on the basis of the constraint hierarchy given in (6).

In what follows, we will demonstrate that the notion of sympathy can straightforwardly save the correct output in (7). Following McCarthy (1997, 1998), as in Tiberian Hebrew, IO-Faith constraints can serve as C❀. In particular,

[7] Here I ignore the candidates [ʔu:t'-it] and [ʔu:t'-ut], both of which violate undominated *HIGHLONG.

it seems reasonable to assume that in Yawelmani IDENT-IO (hi) is responsible for determining the ❁-ed candidate. Since the vowel [u] triggering round harmony in the input in (1a) is [+hi] and the harmony domain is monotonic with respect to [+hi], the ❁-ed candidate must be a candidate that preserves this height feature, i.e., a candidate that observes IDENT-IO (hi).[8] Before turning to the tableau incorporating the sympathy account, let us explain how a ❁-ed candidate is determined among reasonable candidates generated by GEN. The definition of a ❁-ed candidate is given in (8) (Ito & Mester 1997a):

(8) Given a constraint hierarchy [C_1 >> ... C_i >> C❁ >> C_j >> ...C_n], the sympathy candidate selected under C❁ is the candidate that, among the candidates best-satisfying C❁, best satisfies [C_1 >> ... C_i >> C_j >> ...C_n] (i.e., the remainder of the constraint hierarchy).

To put it simply, to be qualified as a ❁-ed candidate, first, candidates have to satisfy C❁. Then, among the candidates satisfying C❁, the most harmonic one is selected as the ❁-ed candidate. Now let us consider the tableau (9).[9] (9b) is selected as the sympathy candidate since (9b), satisfying IDENT-IO (hi), is more harmonic than (9a), which violates ALIGN [+rd].

(9) tableau for ❁-ed candidate: C❁ = IDENT-IO (hi)

	/ʔu:t'-it/	IDENT-IO (hi)❁	ALIGN [+rd]
a.	ʔut'-it		*!
b. ❁	ʔut'-ut		

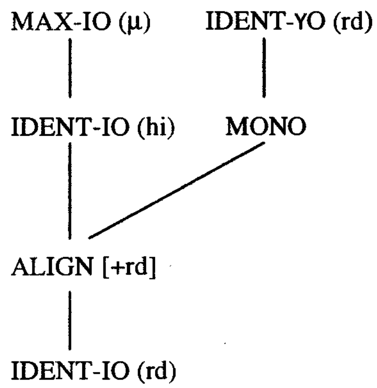
Following Ito & Mester (1997b), we assume that ❁O-Faith constraints can be feature-specific like ordinary IO-Faith constraints. I claim here that the [rd] feature is relevant to the ❁O Faith constraint. More specifically, to obtain the right result, I assume that the relevant ❁O Faith constraint is IDENT-❁O (rd).[10] Let us further assume that IDENT-❁O (rd) has to dominate MONO because as we saw in tableau (7), the actual output crucially violates MONO. Therefore, IDENT-❁O (rd) can circumvent the effect of MONO.

[8] See McCarthy 1998, where it is also claimed that IDENT-IO (hi) can be C❁ in Yawelmani.

[9] For ease of reference, one tableau is divided into two: one tableau is for selecting the ❁-ed candidate and the other tableau is for selecting the actual output. Dividing one tableau into two does not mean that calculation of both the ❁-ed candidate and the actual output takes place separately.

[10] A natural question arises as to why the (rd) feature is chosen as the relevant feature. The reason might be the following: round harmony has to apply to the input, creating an "intermediate stage" and thus roundness of the "intermediate stage" crucially affects the actual output. Since the ❁-ed candidate roughly corresponds to the "intermediate stage", the (rd) feature of the ❁-ed candidate is regarded as the relevant one for the ❁o-Faith constraint.

(10)



Given these assumptions, examine (11). In (11), although the candidate (11c) violates MONO, (11c) wins over (11b) because (11c) satisfies IDENT-❀O (rd): (11c) has a [+round] suffix vowel and the ❀-ed candidate also has a [+round] suffix vowel. However, (11b) violates it because it has a [-round] suffix vowel [i]:

(11) tableau for the actual output:[11]

/ʔu:t'-it/	MAX-IO (μ)	IDENT-❀O (rd)	MONO
a. ❀ ʔut'-ut	*!		
b. ʔo:t'-it		*!	
c. ☞ ʔo:t'-ut			*

Therefore, we can conclude that the sympathy account can correctly capture the opacity interaction between VH and VL.

3.3 Is IDENT-IO (hi) the only Selector?

So far we have claimed that IDENT-IO (hi) is regarded as C❀ to choose the ❀-ed candidates. A question arises here as to whether or not IDENT-IO (hi) is the only selector for a ❀-ed candidate. In this subsection, we will demonstrate that this is not the case. More specifically, we will argue that MAX-IO (μ) can also be a relevant C❀ to determine a ❀-ed candidate.

Before turning to the example in (2), let us consider for the moment the following example in (12), where unlike the example in (2), VH is totally irrelevant:

[11] Here I ignore the candidate [ʔu:t'-ut] as a possible ❀-ed candidate since it violates the undominated Phono-Constraint *HIGHLONG.

(12) UR: /xat-i:n/
VL: i: → e: xat-**e**:n
VS: V: → V/___C]$_\sigma$ xat-**en** 'will eat'

The following tableau (13) shows that the candidate in (13c) would be wrongly selected as optimal without a ❁-ed candidate because it obeys IDENT-IO (hi) in contrast to the actual output (13d):

(13) tableau without ❁-ed candidates: wrong result

/xat-i:n/	*[μμμ]$_\sigma$	*HIGHLONG	MAX-IO (μ)	IDENT-IO (hi)
a. xat-i:n	*(!)	*(!)		
b. xat-e:n	*!			*
c. ❽ xat-in			*	
d. ☞ xat-en			*	*!

However, in (13), if IDENT-IO (hi) is still C❁, we cannot capture the fact that (13d) is the actual output. Look at the tableau (14), which selects the ❁-ed candidate. Since (14b) obeys not only IDENT-IO (hi) but also *[μμμ]$_\sigma$, it is selected as the ❁-ed candidate.

(14) tableau for the ❁-ed candidate:
C❁ = IDENT-IO (hi)

/xat-i:n/	*[μμμ]$_\sigma$	MAX-IO (μ)	IDENT-IO (hi)❁
a. xat-i:n	*!		
b. ❁ xat-in		*	

Next, look at the tableau (15) for the actual output. The actual output (15d) satisfies IDENT-❁O (rd) since (15d) has a [-round] suffix vowel and the ❁-ed candidate also has a [-round] suffix vowel. However, (15d) violates IDENT-IO (hi) because of VL and thus it is wrongly excluded.

(15) tableau for the actual output: wrong result[12]

/xat-i:n/	*[μμμ]$_\sigma$	*HIGHLONG	IDENT-❁O(rd)	IDENT-IO (hi)
a. xat-i:n	*(!)	*(!)		
b. xat-e:n	*(!)			*(!)
c. ❁ ❽ xat-in				
d. ☞ xat-en				*!

[12] Actually, there is no example to indicate the ranking between IDENT-❁$_{HI}$O (rd) and IDENT-IO (hi). But for the sake of argument, I assume that IDENT-❁$_{HI}$O (rd) dominates IDENT-IO (hi).

So the question is how we can accommodate this fact to the sympathy account. Notice that in (12) VL occurs because the high vowel is long in the input. Thus, the sympathy candidate might be a candidate that preserves vowel length, i.e., a candidate that satisfies MAX-IO (μ). Let us assume, then, that in addition to IDENT-IO (hi), MAX-IO (μ) is also responsible for determining a ❁-ed candidate.[13] For ease of reference, let us label ❁$_{MAX}$ the ❁-ed candidate selected by MAX-IO (μ) and ❁$_{HI}$ the ❁-ed candidate selected by IDENT-IO (hi). Examine the tableau in (16). (16b) is selected as the ❁$_{MAX}$-candidate since it does not violate *HIGHLONG:

(16) tableau for the ❁$_{MAX}$-ed candidate:

□ &❁ = MAX-IO (μ)

/xat-i:n/	*HIGHLONG	MAX-IO (μ)❁	IDENT-IO (hi)
a. xat-i:n	*!		
b.❁$_{MAX}$xat-e:n			*

Before turning to the tableau for determining the actual output, I have to point out two crucial assumptions in order to account for the opaque interaction in (12): one assumption is that the ❁O Faith constraint relevant to the ❁$_{MAX}$-candidate, which I call IDENT-❁$_{MAX}$O, must dominate IDENT-IO (hi). Since as the tableau in (13) indicates, the actual output is wrongly excluded due to a violation of IDENT-IO (hi), the effect of IDENT-IO (hi) must be circumvented. The other assumption is that IDENT-❁$_{MAX}$O has to be specific to the height feature.[14] Consider the tableau (17).

(17) tableau for the actual output: IDENT-❁$_{MAX}$ O (hi) >> IDENT-IO (hi)

/xat-i:n/	$*[\mu\mu\mu]_\sigma$	IDENT-❁$_{MAX}$O (hi)	IDENT-IO (hi)
a.❁$_{MAX}$ xat-e:n	*!		*
b. xat-in		*!	
c. ☞ xat-en			*

In (17), the candidate (17c) is correctly selected as the optimal candidate since it does not violate either $*[\mu\mu\mu]_\sigma$ or IDENT-❁$_{MAX}$O (hi). On the other hand, the candidate (17b) violates IDENT-❁$_{MAX}$O (hi) since the vowel height of the suffix in (17b), which is [+high], is not identical with that of the suffix in the ❁$_{MAX}$-candidate (17a), which is [-high]. Therefore, on the assumption that MAX-IO (μ) is qualified as C❁, we can explain the fact that (17c) is the actual output.

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[13] See McCarthy 1998, where it is also claimed that MAX-IO (μ) can be C❁ in Yawelmani. Note that McCarthy's (1998) analysis of Yawelmani is basically the same as the analysis presented here, although McCarthy does not provide extensive discussion concerning Yawelmani vocalic alternations and the mechanism of multiple ❁-ed candidates. For further discussion, see Hoshi 1998, where it is argued that the "sympathy" analysis in OT is superior to the "rule-based" approach in generative phonology.

[14] The reason why IDENT-❁$_{MAX}$O is specific to the (hi) feature might be that the "intermediate stage" created by the application of VL roughly corresponds to the ❁-candidate and thus the (hi) feature of the ❁-candidate is crucial to determining the actual output.

4 On the Necessity of Multiple Sympathy Candidates

4.1 Counter-Feeding & Counter-Bleeding

So far we have shown that both IDENT-IO (hi) and MAX-IO (μ) serve as C❀ to determine the ❀-candidates. Let us now examine the example in (2). Note here that in (2), VL need not occur to avoid a violation of *HIGHLONG since VS eventually takes place (= counter-bleeding). Thus *bok'-in* would be expected, but actually it is excluded. In addition, VH is expected to take place because the domain of round harmony is monotonic with respect to vowel height (= counter-feeding). So, *bok'-on* would be expected because both [o] and [e] are specified as [-high], but, in fact, VH does not occur.

Here I demonstrate that (2) is an example where multiple ❀-ed candidates are necessary to explain the vocalic alternations in a single form. Developing the original idea of sympathy given by McCarthy (1997), I propose that every IO-Faith constraint serves as C❀ regardless of whether or not the actual output violates it. Let us examine the tableaux (18) and (19). What is crucial here is that now we have multiple ❀-ed candidates related to both MAX-IO (μ) and IDENT-IO (hi): both a ❀$_{MAX}$ and a ❀$_{HI}$-candidate come into play at the same time in one tableau to regulate the identification between the multiple ❀-ed candidates and the possible outputs.

In (18i), which is the tableau for the ❀$_{MAX}$-candidate, the candidate (18ic) is chosen as the ❀$_{MAX}$-candidate since it obeys ALIGN [+rd]. In (18ii), which is the tableau for the ❀$_{HI}$-candidate, the candidate (18iib) is regarded as the ❀$_{HI}$-candidate since it does not violate MONO or any of the relevant Phono-Constraints.

(18) tableaux for multiple ❀-ed candidates:

i. C❀ = MAX-IO (μ)

/bok'-i:n/	*HIGHLONG	MAX-IO (μ)❀	IDENT-IO (hi)	ALIGN [+rd]
a. bok'-i:n	*!			*
b. bok'-e:n			*	*!
c.❀$_{MAX}$bok'-o:n			*	

ii. C❀ = IDENT-IO (hi)

/bok'-i:n/	*[μμμ]$_σ$	IDENT-IO (hi)❀	MONO	ALIGN [+rd]
a. bok'-i:n	*!			*
b.❀$_{HI}$ bok'-in				*
c. bok'-un			*!	

(19) tableau for the actual output:

/bok'-i:n/	*[μμμ]$_σ$	IDENT-❁$_{MAX}$O (hi)	IDENT-❁$_{HI}$O (rd)
a.❁$_{MAX}$ bok'-o:n	*!		*
b.❁$_{HI}$ bok'-in		*!	
c. bok'-on			*!
d. bok'-un		*(!)	*(!)
e. ☞ bok'-en			

As indicated in the tableau (19), we can successfully exclude the competing candidates because of the two ❁O-Faith constraints. The candidate in (19a) is immediately excluded because it violates *[μμμ]$_σ$. (19b) is ruled out because of a violation of IDENT-❁$_{MAX}$O (hi): it has a [+high] suffix vowel, but the ❁$_{MAX}$-candidate has a [-high] suffix vowel. The candidate in (19c) is excluded due to a violation of IDENT-❁$_{HI}$O (rd): (19c) has a [+round] suffix vowel, but the ❁$_{HI}$-candidate in (19b) has a [-round] suffix vowel. Finally, the candidate (19d) is ruled out because of a violation of both IDENT-❁$_{MAX}$O (hi) and IDENT-❁$_{HI}$O (rd): the height and the round features in the suffix of (19d) are not identical with those of the ❁$_{MAX}$-candidate and the ❁$_{HI}$-candidate, respectively. Therefore, (19e), which both satisfies IDENT-❁$_{MAX}$O (hi) and IDENT-❁$_{HI}$O (rd), can be selected as the optimal candidate by postulating multiple ❁-ed candidates.

Notice that the two IDENT-❁O constraints play very crucial roles in selecting the actual output in the tableau (19). Without IDENT-❁$_{MAX}$O (hi), [bok'-in] in (19b), which satisfies IDENT-IO (hi), would be chosen as optimal since the actual output (19e) violates IDENT-IO (hi) ([i:] is changed into [e] in (19e)). On the other hand, if it were not for IDENT-❁$_{HI}$O (rd), then [bok'-on] in (19c) would be wrongly selected as the optimal output since it does not violate ALIGN [+rd], but the actual output in (19e) violates it ([e] is not changed into [o]). Thus, we can conclude that we need at least two ❁-ed candidates in order to account for the counter-bleeding & counter-feeding cases of opacity, which suggests that the analysis of multiple ❁-ed candidates is empirically well-motivated.

Next, let us examine the following example which also involves the interaction among VH, VL and VS. Consider the example in (3) and the tableaux (20i) and (20ii), which determine the ❁$_{MAX}$-candidate and the ❁$_{HI}$-candidate, respectively. In (20i), (20ib) is selected as the ❁$_{MAX}$-candidate since it does not violate MONO. In (20ii), (20iib) is chosen as the ❁$_{HI}$-candidate since it does not violate ALIGN [+rd]:

(20) tableaux for multiple ❁-ed candidates:

i. C$^{❁}$ = MAX-IO (μ):

/dub-i:n/	*[μμμ]$_σ$	MAX-IO (μ)$^{❁}$	MONO	ALIGN [+rd]
a. dub-o:n	*		*!	
b.❁$_{MAX}$ dub-e:n	*			*

ii. C❁ = IDENT-IO (hi):

/dub-i:n/	IDENT-IO (hi)❁	ALIGN [+rd]
a. dub-in		*!
b. ❁HI dub-un		

(21) tableau for the actual output:

/dub-i:n/	*[μμμ]σ	IDENT-❁MAXO (hi)	IDENT-❁HIO (rd)
a.❁MAX dub-e:n	*!		
b.❁HI dub-un		*!	
c. dub-en			*!
d.☞ dub-on			

In (21), the candidate (21d) is regarded as optimal since it satisfies all the relevant constraints. The competing candidate (21b) fatally violates IDENT-❁MAXO (hi): (21b) has a [+high] suffix vowel [u], which is incompatible with the [-high] suffix vowel [e] of the ❁MAX-candidate. The other competing candidate (21c) violates IDENT-❁HIO (rd): (21c) has the [-round] suffix vowel [e], which is incompatible with the [+round] suffix vowel [u] of the ❁HI-candidate in (21b).

4.2 Counter-Feeding

In this subsection we will examine the case with counter-feeding only and confirm that the same analysis applies to counter-feeding.

Consider the example of counter-feeding in (1b). The relevant tableaux for the counter-feeding case are as in (22). In (22i), the candidate (22ib) is more harmonic than the other candidate since it satisfies ALIGN [+rd], whereas the competing candidate (22ia) violates it; (22ib) is thus selected as the ❁MAX-candidate. Tableau (22ii) shows that the candidate (22iia) is the ❁HI-candidate due to the fact that it satisfies MONO:

(22) tableaux for ❁-ed candidates:

i. C❁ = MAX-IO (μ):

/ʔu:t'-ʔas/	MAX-IO (μ)❁	IDENT-IO (hi)	ALIGN [+rd]
a. ʔo:t'-ʔas		*	*!
b.❁MAX ʔo:t'-ʔos		*	

ii. C❁ = IDENT-IO (hi):[15]

/ʔu:t'-ʔas/	IDENT-IO (hi)❁	MONO	ALIGN [+rd]
a. ❁HI ʔut'-ʔas			*
b. ʔut'-ʔos		*!	

[15] Here I ignore the candidate [ʔu:t'-ʔas] because it violates undominated *HIGHLONG.

(23) tableau for the actual output:

/ʔu:t'-ʔas/	IDENT-❁$_{MAX}$O (hi)	IDENT-❁$_{HI}$O (rd)
a. ❁$_{HI}$ ʔut'-ʔas	*!	
b.❁$_{MAX}$ ʔo:t'-ʔos		*!
c. ☞ ʔo:t'-ʔas		

(23a) is excluded due to a violation of IDENT-❁$_{MAX}$O (hi). The actual output (23c) satisfies both of the IDENT-❁O constraints in contrast to the competing candidate (23b), in which IDENT-❁$_{HI}$O (rd) is fatally violated because of the [+round] the suffix vowel [o], which is not identical with the [-round] suffix vowel [a] of the ❁$_{HI}$-candidate. Therefore, (23c) can be correctly selected as the optimal candidate.[16]

5 Concluding Remarks

We have argued that every IO-Faith constraint serves as C❁, which implies that there exist "multiple sympathy candidates" and that more than one ❁O-Faith constraint selected by multiple ❁-ed candidates are allowed to evaluate the candidates generated by GEN in a parallel fashion. Notice that if we just take a look at opaque languages in which only one ❁-ed candidate might be relevant, we cannot say anything decisive about the possibility of "multiple ❁-ed candidates". However, if there is a language such that more than one ❁-ed candidate play an important role in the grammar of the language, then it sounds reasonable to assume that ❁-ed candidates can be multiple, which is exactly the case of vocalic alternations in Yawelmani that we have seen so far. A stronger claim is that, on the basis of the assumption that every IO-Faith constraint serves as C❁, in any language, a ❁-ed candidate exists and ❁-ed candidates can be multiple. However, whether or not ❁-ed candidates come into play in the grammar of a language depends on its independent constraint hierarchy. Consider the following abstract schemata of the constraint-hierarchies (24), in which we can make a distinction among the languages with or without opacity effects:

[16] The actual output in (27c) apparently violates $*[\mu\mu\mu]_\sigma$, but note here that the consonant [t'] is a glottalized C and to my knowledge this is the only exception for $*[\mu\mu\mu]_\sigma$. I tentatively assume that the glottal stop [ʔ] is not counted as a crucial segment for the purpose of syllabification and thus VS does not apply to (27c).

(24) a. "Transparent" languages:

$C_1 \gg C_2 \gg \ldots \gg C_n \gg \ldots \gg$ ❀O-FAITH$_{1,\,2,\,3,\,\ldots n}$

b. "Opaque" languages:

$C_1 \gg$ ❀O-FAITH$_1$ $\gg C_2 \gg \ldots \gg C_n \gg \ldots \gg$ ❀O-FAITH$_{2,\,3,\,\ldots n}$

c. "More opaque" languages:[17]

$C_1 \gg$ ❀O-FAITH$_1$ $\gg C_2 \gg$ ❀O-FAITH$_2$ $\gg \ldots \gg C_n \gg \ldots \gg$ ❀O-FAITH$_{3,\,\ldots n}$

In the case of what I call "transparent" languages, the family of ❀O-Faith constraints are lowest-ranked, and they do not exhibit any substantial effects in the grammar. As for "opaque" languages, one member of the family of ❀O-Faith constraints is higher-ranked than some other Phono-Constraints or IO-Faith constraints, and thus it comes into play, yielding usual "opacity" effects. On the other hand, in the case of what I call "more opaque" languages such as Yawelmani, more than one ❀O-Faith constraints are higher-ranked and crucially affect the choice of the actual output. Therefore, from the fact that the typology of "opacity" fits perfectly into the framework of OT, it seems tenable to conclude that "multiple ❀-ed candidates" are allowed in the grammar of any language, regardless of whether or not it exhibits "opacity" effects.

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[17] Here "more opaque" means that the degree of opaqueness is higher. This seems to be intuitively correct. Notice that in Yawelmani, VH, VL and VS interact with one another and create more than one "intermediate stages" in terms of the "rule-ordering" analysis, in contrast to the example involving vowel epenthesis and ʔ-deletion in Tiberian Hebrew, in which McCarthy (1997) shows that only one "intermediate stage" is involved. However, see Idsardi 1998 and McCarthy 1998 for more complicated "opaque" examples of spirantization in Tiberian Hebrew.

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