COMPUTATION EFFICIENCY AND FEATURE INHERITANCE IN CRASH PROOF SYNTAX

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Frampton and Guttmann (2002) argue that a Language design that assumes "crashing derivations" would seem to be less computationally efficient than a design which outputs only convergent derivations. Therefore, they advocate a "Crashproof" syntax which requires constraining all the computational operations. Merge (External and Internal) and Agree are such operations. Another operation that precedes and drives Agree and Internal Merge/Move (Ouali 2006 and 2008) is Feature Inheritance (Chomsky 2000, 2001 and 2004). I show that such operation can be compatible with crashprrof syntax. I argue, given data from Tamazight Berber, that the three logical possibilities of feature inheritance namely Donate, Keep, and Share, proposed in Ouali (2006, 2008), and whose application is ranked with Keep applying only if Donate fails, and Share applying only of Keep fails, despite requiring seemingly different derivations can be accounted for within a crashproof syntax.

1. Introduction

Within Minimalism, Language as an "optimal" design requires a computation system that is designed to satisfy only interface conditions. Chomsky puts the main burden on the interface conditions when it comes to the computational operation merge. According to him merge is "free" which allows for a system where derivations may crash at the interfaces if certain conditions are not met. Other scholars, such as, Frampton and Guttmann (1999, 2002)

view this as inconsistent with computation efficiency and argue for a model where the burden is put only on the computational operations such as merge; therefore yielding a "crash-proof" system, i.e. a system where only convergent derivations are derivable and reach the interfaces.

Taking the "crash-proof" syntax premise seriously, there are other computational operations that need to be constrained namely Agree and Move (or Internal Merge).[1] However, there is another operation that precedes Agree namely Feature inheritance, which this paper will focus on and which raises questions especially with regard to computational efficiency. Within Chomsky's (2000, 2001 and 2004) recent proposals, Agree, between the "probe" T and the "goal" DP subject in a finite clause, for example, is preceded by "feature inheritance". For Chomsky, C, the phase head, is the locus of φ-features and T inherits these features from C. T only enters into an Agree relation with its goal upon inheriting the φ-features from C.[2] Ouali 2006 and 2008 questions the logic in Feature inheritance and asks why C, the locus of φ-features, has to always transfer it features to T. Ouali argues for three different feature inheritance mechanisms namely KEEP, DONATE and SHARE as logical possibilities of the feature inheritance mechanism proposed in Chomsky (2000, 2001 and 2004) and provides empirical evidence from Berber in support of these possibilities. He also argues that these mechanisms are ordered with DONATE applying first, KEEP applying when DONATE fails, and SHARE applying only when both DONATE and KEEP fail. The question arises is what does it mean for the application of one of these mechanisms to fail? For Ouali 2006 and 2008 a feature inheritance mechanism fails when it does not generate a convergent derivation. Convergence only arises at the interfaces. Therefore, Ouali's system at first seems to be computationally inefficient requiring a derivation to crash for one feature-inheritance mechanism to apply over another. In this paper, I will show that this is not necessarily the case. Failure of DONATE or KEEP can be detected prior to Spell-out before reaching the interfaces if we appeal to the Activation Condition (Chomsky 2000, 2001, 2004). I will argue that a derivation doesn't get spelled out if a probe or a goal is active i.e. is bearing an unchecked feature, and consequently, one can still

maintain a crash Proof Syntax as proposed in Frampton and Gutmann (2002). The paper is organized as follows: section 2 is about feature inheritance, section 3 discusses subject verb agreement in English, section 4 presents an analysis of Anti-Agreement Effect, section 5 is about long distance extraction, and section 6 is about the order of application of KEEP, DONATE, and SHARE and how they land support to a Crash Proof system over a "free" system.

2. Feature Inheritance

One of the developments in recent Minimalist theorizing is the elimination of Spec-Head as a syntactic relation (see Chomsky 2000, 2001, and 2004) and replacing it with a C-Command Probe-Goal relation. Consequently, Spec-Head agreement within a Probe-Goal approach is underivable.[3] Alternatively, Chomsky argues that agreement is obtained as a result of an Agree operation that takes place upon establishing a Probe-Goal relation between a probing head and a target goal which is in the Probe's c-command domain. Subject-verb agreement, for example, is obtained as a result of a relation established between T, which bears uninterpretable and unvalued φ-features, and the subject, which bears among its features an uninterpretable unvalued Case feature, in Spec-*v*P. Bearing an uninterpretable and unvalued feature is a pre-condition for a Head or Phrase to be an active Goal or an active Probe respectively. Only by virtue of being active can a Goal and Probe enter into an Agree relation.[4]

(1) **Activation Condition (AC)**
Both a probe X and a goal Y must have an uninterpretable feature (*u*F) to be active and participate in Agree.

(2) Agree
The probe P agrees with the closest matching goal in D.
a. Matching is feature identity
b. D is the sister of P. [D= c-command Domain of P]
c. Locality reduces to closest c-command

(Chomsky 2000: 122)

Chomsky (2004, 2005) hypothesizes that C is the locus of φ-features and that T inherits these features from C. Ouali (2006, 2007, and 2008) argues that Chomsky's feature inheritance mechanism allows three logical possibilities which are all empirically attested in languages such as Berber. These feature inheritance mechanisms are DONATE, KEEP, and SHARE. DONATE is the case of simple declarative clauses as stated (3) and schematized in (4):

(3) DONATE
Transfer φ-features from C to T without keeping a copy.

(4) C T Subject *Declaratives*
DONATE AGREE

(Ouali 2008)

KEEP, is the case of local subject extraction namely subject wh-clauses, clefts and subject relative clauses, which yield the so-called Anti-Agreement Effect (AAE) (Ouhalla 1993, 2005). This is stated in (5) and schematized in (6) (the representation shows the subject in situ prior to extraction; the position that is relevant for Agree to be established):

(5) KEEP
No φ-features transfer from C to T.

(6) C T Subject *AAE*
KEEP
AGREE

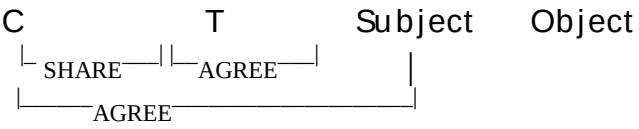
(Ouali 2008)

SHARE, is the case of object local extraction, and subject or object long distance extraction. SHARE is stated in (7) and Local object extraction is schematized in (8) below (here also the subject and object are in situ):

(7) SHARE

Transfer φ-features from C to T and keep a copy.

(8)



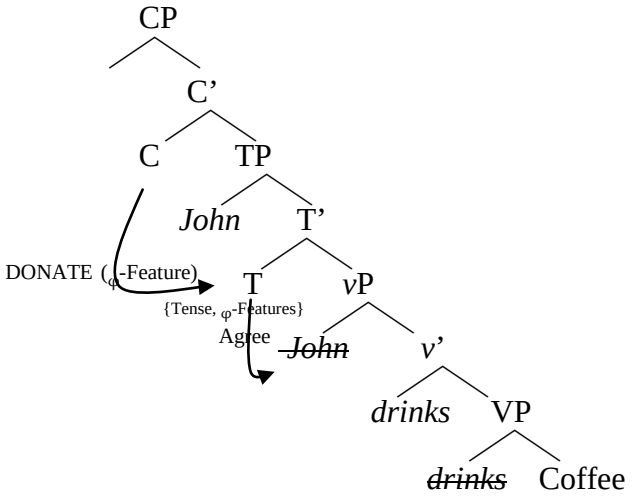
Ouali (2006, 2008) argues that the application of DONATE, KEEP and SHARE is ordered with DONATE applying first and if that yields a derivation crash, KEEP then applies and if that in turns yields a crash, SHARE applies. Derivation crash, as mentioned above, is not desirable given computation efficiency and Crash-Proof syntax. I will show that the ordering of application of these three mechanisms is empirically motivated given Berber facts, and theoretically desirable given principles of economy. The ordering of application of these mechanisms can be explained within Crash-Proof syntax by appealing to AC.

3. Subject-verb Agreement: English

Chomsky (2001, 2004) argues that subject verb agreement is obtained as a result of Agree between T and the subject. T inherits its φ-features from C (what Ouali 2006 and 2008 calls DONATE); i.e. upon merging C, it transfers its [-interpretable] φ-features to T, and only then T, now having [-interpretable] φ-features, probes the subject. As a result of an Agree operation defined in (2), these φ-features are valued and deleted as illustrated in (9) and (10).

(9) *John drinks coffee*

(10)



A possible motivation and reason for DONATE is minimal search; the subject is closer to T than to C in terms of c-command path. One could argue that "closeness" in terms of c-command is more computationally efficient than the opposite. As pointed out in Ouali (2008), in principle, C could retain its φ-features hence remain an active probe and enter into an agreement relation with the subject. In this case it would have to probe the subject over T violating "locality conditions" (see Chomsky 2004 among others), therefore KEEP doesn't apply (see section 3 for more arguments for the order application of DONATE and KEEP).[5] Chomsky also argues that Feature inheritance is crucial for A/A-bar distinction and Richards 2007 argues that T inheriting C's φ-features is a conceptual necessity in a phase type model.

Does C transmit its φ-features to T in declarative clauses without keeping a copy of these features, in other words could SHARE apply?

The answer to this question, considering the example from English represented in (10), is no for the following reason:

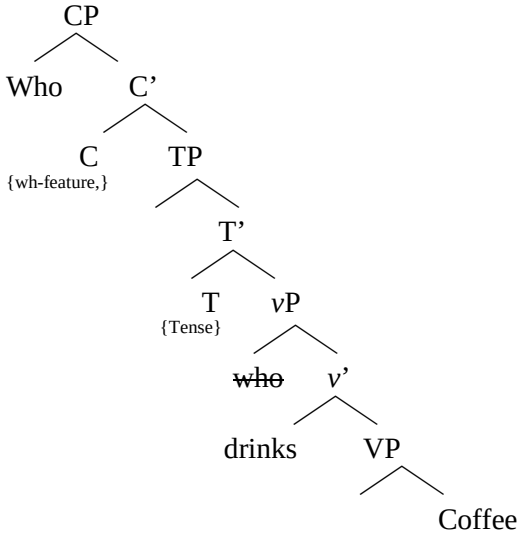
These φ-features are [-interpretable] and presumably make any head that bears them 'active'. If C transfers them to T and retains a copy, now both C and T are active and would act as Probes. Minimal

search would enable T, now bearing [-interpretable] φ-features to probe the subject. After the Agree operation takes place the φ-features on T are valued as well as the case feature on the DP subject. C, now bearing a copy of the [-interpretable] φ-features will not be able to find an active goal because the case on the subject DP has been valued and hence it is inactive and invisible to C. Therefore, if C retains a copy of φ-features, the derivation is doomed to crash. This led Ouali (2006, 2008) to conclude that, in declarative finite clauses such as (9), when C is merged DONATE applies.

As pointed out in Ouali (2008), assuming DONATE and AC, leads to a puzzling question and that is: how do we ever get wh-questions in English? Consider the following sentence in (11) represented in (12).

(11) Who drinks coffee?

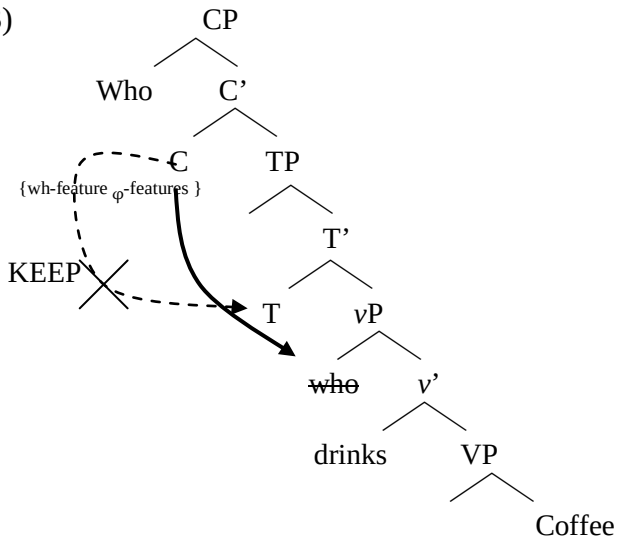
(12)



With the assumption that the wh-word has a [-interpretable] wh-feature whereas C has a [+interpretable] wh-feature, let us see what happens if we apply DONATE.[6] C transfers its φ-features to T without keeping a copy. Now T is active by virtue of bearing [-

interpretable] φ-features whereas C is not. T probes and Agrees with the wh-subject, and as a result of this agreement the φ-features on T are valued as well as the case feature on the wh-subject. The [-interpretable] wh-feature on the wh-word is not however valued, and will not be able to be valued because the head that is needed for this to happen, namely C, is now inactive because it transferred its [-interpretable] φ-features to T. The derivation is doomed to crash. At this point, and unlike Ouali (2008) I argue that the derivation doesn't reach Spell Out since there is still an active item bearing an unvalued feature. KEEP then applies and C now has φ-features and a wh-feature as represented in (13).

(13)



C retains its φ-features and enters into a Probe-Goal Match relation with the subject. C is φ-complete therefore should be able to value the case feature on the DP. It should also be able to value the wh-feature on the subject. Although it looks like what we get in English subject wh-questions is "C-agreement", it may be morphological similar to "T-agreement"; the reason why we do not observe the same effects we see in Tamazight Berber. Tamazight Berber provides empirical evidence for KEEP and this will be discussed in the next section. The point that needs to be stressed here is that applying KEEP does not result from a derivation crash. It is invoked

as a result of AC before the derivation reaches Spell Out, hence compatible with Crash Proof Syntax.

4. Subject extraction and Anti-Agreement Effects

Verbs in Tamazight Berber (TB) are always inflected for subject agreement. The agreement element can co-occur with the subject as illustrated in (14).

(14) *ytsha* *wrba* *thamen*
3s.eat.PERF boy honey
'The boy ate honey'

There are three contexts which show lack of subject-verb agreement in Tamazight and in Berber in general as pointed out by researchers such as Ouhalla (1993, 2005b) (see also Ouali 2006, 2007, 2008). These are: subject-wh clauses, subject-relative clauses, and cleft-constructions. The obligatory lack of agreement between the verb and the subject, triggered by extraction of the subject is called Anti-Agreement Effect (AAE) (Ouhalla (1993, 2005), Richards (2001) and Ouali and Pires (2005), among others. If we look at the two examples in (15) and (16), we see that the subject-verb agreement is overtly marked on the verb.

(15) *thʕla* *thamttut* *araw* VSO
3sf- seePERF woman boys
'The woman saw the boys'

(16) *thamttut* *thʕla* *araw* SVO
woman 3sf**.**see.PERF boys
'The woman saw the boys'

This subject-verb agreement is suppressed in the subject extraction environment. (17) is an example of a subject wh-extraction which shows AAE on the verb; and as illustrated by (18), full subject-verb agreement is impossible.[7]

(17) *mani thamttut* *ag* *ʕlan* *araw*
which woman COMP see.PERF.*Part* boys
'Which woman saw the boys'

(18) **mani thamttut* *ag* *thʕla* *araw*
which woman COMP 3sf.see.PERF boys
'which woman saw the boys?'

The same pattern is observed in subject relative clauses as in (19) and (20), and clefts in (21) and (22) where subject verb agreement is again impossible.

(19) *thamttut* *ag* *3lan* *araw*
woman COMP see.PERF.*Part* boys
'The woman who saw the boys…'

(20) **thamttut* *ag* *thʕla* *araw*
woman COMP 3sf-see.PERF boys
'the woman who saw the boys…'

(21) *thamtutt-a* *ag* *ʕlan* *araw*
woman-this COMP see.PERF.*Part* boys
'It was this woman that saw the boys'

(22) **thamtutt-a* *ag* *thʕla* *araw*
woman-this COMP 3sf-see.PERF boys

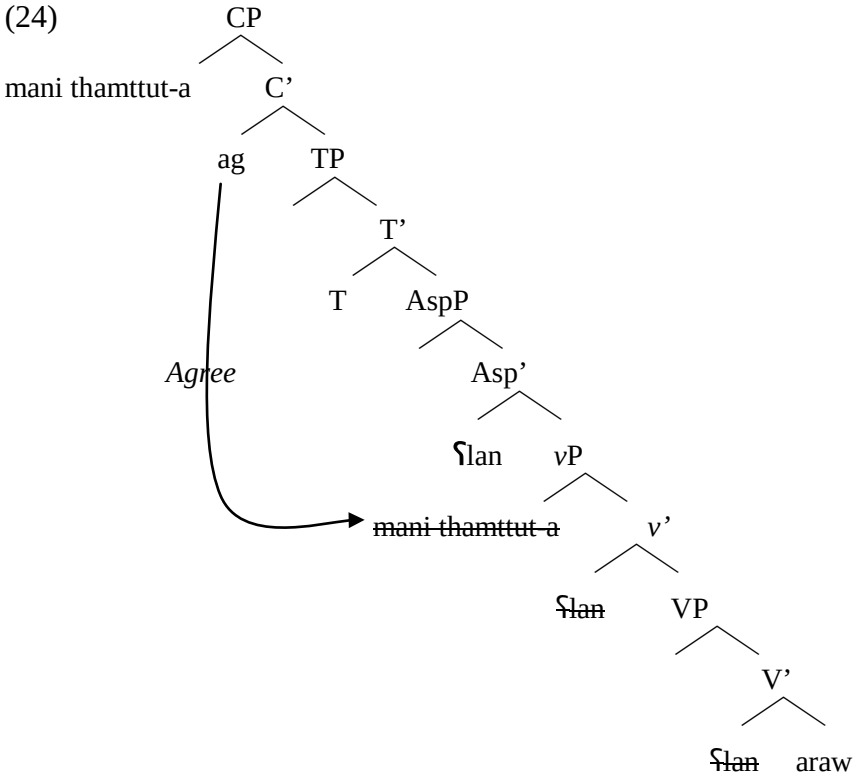
Let us first review how Ouali (2006, 2008) accounts for these facts under a derivational approach and given the Probe-Goal Relation and the Agree operation adopted here and also given the hypothesis that T inherits the φ-features from C. Note that Agree holds between T which is specified for a full set of unvalued φ-features and the subject which is specified for valued φ-features and unvalued case feature; and according to Chomsky's analysis the case feature of the DP gets valued and deleted as a "reflex" or a result of full agreement in φ-features between the probe T and the goal DP. If full agreement is a pre-requisite for case valuation and deletion, how can one derive the Berber subject extraction facts where T presumably is not specified for a full set of φ-features?

Take for example the wh-sentence from Tamazight Berber repeated in (23).

(23) *mani thamttut* *ag* *ʕlan* *araw*
which woman COMP see.PERF.Part boys
'Which woman that saw the boys'

Given DONATE in (3), let us examine the representation of this sentence in (24).

(24)



If DONATE applies T will probe the wh-subject and agree with it; agree meaning the [-interpretable] φ-features on T are valued and the case feature on the subject is also valued. C, now bearing only [+interpretable] wh-feature, will not be active and the subject, which is still active by virtue of bearing an uninterpretable wh-feature will

not get this feature checked. Recall that this is exactly the same puzzle pointed out regarding English Wh-questions. Ouali (2008) argues that the Numeration is now exhausted and there is no hope for the wh-subject to get its wh-feature valued therefore the derivation crashes. Contrary to this, I argue that the derivation in this case can not be spelled out. A second option is available and that is KEEP: C does not transmit its φ-features to T, in for example wh-clauses, for the reasons mentioned above. Descriptively, AAE seems to be a repair strategy that results from enabling C to probe the wh-word and Agree with it. How does that take place at the feature level? When C is merged it does not transmit its [-interpretable] φ-features to T, and therefore remains active. T bears [+interpretable] tense features and since it does not receive the [-interpretable] φ-features it will remain inactive. The wh-subject bears valued [+interpretable] φ-features, unvalued [-interpretable] Case, and [-interpretable] wh-feature. Principles of minimal search will force C to search for the closest goal, which is the active subject. As a result of Agree the φ-features on C are valued and the wh-feature on the subject is also valued. The question arises if the φ-features on T are "suppressed" how does the Case feature on the DP get valued and deleted? There is a good reason here to assume that this happens as a result of Agree with the φ-complete C. Since according to Chomsky (2000 and 2004), case valuation is a reflex of a Match relation and Agree between the φ-complete T and the DP, there is absolutely nothing that would prevent the same to happen when a φ-complete C probes a subject DP. As a result of KEEP we expect not to have "T-agreement", i.e. no agreement between T and the subject, hence the so-called AAE is deduced.

5. Long Distance Agreement

As first noted in Ouhalla (1993) and discussed in Ouali & Pires (2005), The AAE disappears in Berber when the subject is long-distance extracted; i.e. when it is extracted from an embedded clause to the front of a matrix clause. If we look at (25), we see that the

subject is in post-verbal position and the verb is inflected for full agreement.

(25) *thʕa* *meriam* *araw*
leave.IMP.3sf **Miriam** boys
'Miriam saw the boys'

On the other hand, in (26), a cleft construction where the subject is in pre-verbal position, we see that the verb shows AAE.

(26) *meriam* *ag* *ʕan*
Meriam Comp saw.IMP.Part
'It was Miriam that saw the boys'

In (27) the subject is extracted from the embedded clause all the way to the front of the matrix clause and as we can see only full subject-verb agreement is allowed on the embedded verb.

(27) *ma* *ag* *inna* *ali* *thʕa* *(*ʕan)* *araw*
who Comp 3.s.said ali 3sf.swa (*saw.Part) boys
'Who did Ali say saw the boys'

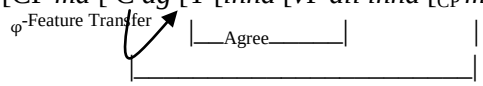
The derivation of the lower CP phase in (27) is represented in (28):

(28) *ma* *ag* *inna* *ali* [$_{CP}$ ~~*ma*~~ C [T [*thʕa* [*v*P ~~*ma*~~ *thʕa araw*
φ-Feature Transfer |____Agree_____|
Who Comp said ali who ~~3sf.swa~~ who ~~3sf.swa~~ boys

By virtue of DONATE (first option available), the embedded C, which does not bear a wh-feature, transfers it φ-features to T and T then agrees with the wh-subject. Up to this point the [-interpretable] wh-feature on the subject has not been valued yet. Does the derivation crash? The answer is no because the Numeration has not been exhausted yet which therefore means that there still is hope for the wh-subject. At the embedded CP level we get "T-agreement" hence full subject-verb agreement and now the wh-subject moves the

intermediate Spec-CP. Notice that now the derivation can be sent to Spell Out. The wh-word which is on the edge of the lower CP phase is accessible to "matrix" probes, and what it is spelled out is the lower CP excluding the active wh-word. The higher CP phase is represented in (29):

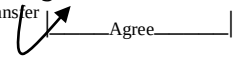
(29) [CP *ma* [C *ag* [T [*inna* [*v*P *ali* ~~*inna*~~ [$_{CP}$ ~~*ma*~~ *th ʕla* [*v*P ~~*ma*~~ *th ʕla araw*



Who Comp said ali ~~3s.aid~~ [$_{CP}$ ~~who~~ 3sf.saw [*v*P ~~who~~ ~~3sf.saw~~ boys

The first available option is DONATE by which the matrix C, which bears a [+interpretable] wh-feature, transfers its φ-features to T as represented in (29). Remember that at this point we have not valued the wh-feature of the wh-word yet. When C transfers its φ-features to T it (C) will not remain active and consequently it will not act as probe and Agree with the embedded wh-subject. The Numeration has been exhausted, and there remains no hope for the wh-subject. Unlike in Ouali (2006, 2008), here again, I argue that the derivation doesn't crash because it can not reach Spell Out with a still-active wh-word. Now there is no other solution but to try KEEP. Given KEEP the matrix C retains its φ-features, and therefore is active. Minimal search forces C to search for the closest goal which is the matrix subject. Even though C bears a wh-feature, this feature is valued and [+interpretable], which means Agree with matrix subject would go through; C gets its φ-features valued and the matrix subject gets its case feature valued. Now C is inactivated and will not probe the active embedded wh-subject which is in the intermediate Spec-CP. Here again the Numeration is exhausted, no hope remains for the subject, and the derivation cannot be spelled out.

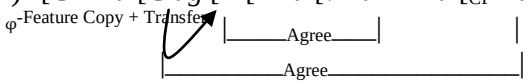
(30) [CP *ma* [C *ag* [T [*inna* [*v*P *ali* ~~*inna*~~ [$_{CP}$ ~~ma~~ *th ʕla* [*v*P ~~*ma*~~ *th ʕla araw*



Only at this stage and as a last resort is SHARE, the third feature inheritance mechanism invoked, invoked. Since this is a last resort

option, the derivation up to the embedded CP (lower CP phase) proceeds as explained in (28) appealing to DONATE, because the Numeration at the point of the intermediate CP is not exhausted and there is still hope for the subject. As we reach the matrix CP, and as we just saw DONATE and KEEP are both exhausted, and the last hope is SHARE. Let us examine how SHARE operates.

(31) [CP *ma* [C *ag* [T [*inna* [*v*P *ali* ~~*inna*~~ [$_{CP}$ ~~*ma*~~ *th ʕla* [*v*P ~~*ma*~~ *th ʕla araw*



The matrix C, which bears a [+interpretable] wh-feature, transfers its [-interpretable] φ-features to T and keeps a copy of these features. As a result, both C and T are now active probes. Minimal search enables T to find the closest active DP, namely the matrix subject. Agree takes place, now both matrix T and matrix subject are inactive and "T-agreement" is obtained. C, still active, probes the closest active DP, which is the embedded wh-subject in intermediate Spec-CP (or in Spec-vP). Again, Agree takes place, the φ-features on C are valued as well as the wh-feature on the wh-subject, no there remains no Active probe or Active Goal and the the derivation converges. As noted in Ouali (2006, 2008), Agree applies upon establishing a c-command Probe-Goal Match relation and it applies independently of Move. Move or internal merge is motivated by other independent mechanisms. For Chomsky, it is the EPP and for Epstein and Seely (2006) it is case. The intermediate movement of the wh-word to the intermediate Spec-CP is not forced by feature-checking, but rather by other mechanisms e.g. locality, as proposed by Boskovic (2002), or also as the result of the need for elements to move to the edge of the phase in order to check features in a higher projection later.

This analysis makes a prediction that an "agreeing" C i.e. a C that does not transmit its φ-features to T, should be different from a non-agreeing C i.e. a C that transmits its φ-features to T. This is exactly what we observe in Tamazight Berber and in Berber in general. In local extraction contexts such as (32) Comp is obligatory otherwise the sentence becomes ungrammatical as in (33):

(32) *ma* *ag* *swan* *aman*
who Comp drink.PERF.Part water
'Who drank water?'

(33) **ma* *swan* *aman*
who drink.PERF.Part water
'Who drank water?'

In long-distance extraction, on the other hand, Comp is disallowed in the embedded clause as illustrated by (34) and (35). This, also as noted in Ouali (2006, 2008) is a strong empirical evidence for C agreement or lack thereof. In other words, C agreement is disallowed when T agreement (subject verb agreement) is allowed and C agreement is allowed where T agreement is disallowed.

(34) *ma ay thenna Fatima iswa aman*
who Comp 3sf.say.PERF Fatima 3sm.drink.PERF water
'Who did Fatima say drank water?'

(35) **ma ay thenna Fatima ay iswa aman*
who Comp 3sf.say.PERF Fatima Comp 3sm.drink.PERF water
'Who did Fatima say drank water?'

An even stronger prediction is that in long distance extraction contexts and given SHARE, we expect to see both "T-agreement" and "C-agreement" when this happens in the matrix domain. This prediction is born out as we see in (34) repeated in (36):

(36) *ma ay thenna Fatima iswa aman*
who Comp 3sf.say.PERF Fatima 3sm.drink.PERF water
'Who did Fatima say drank water?'

If we drop "T-agreement" we get an ungrammatical sentence as we see in (37).

(37) **ma ag nan Fatima iswa aman*
who Comp say.PERF.Part Fatima 3sm.drink.PERF water
'Who did Fatima say drank water?'

Also, if we drop “C-agreement” we get, again, an ungrammatical sentence as in (38):

(38) **ma thenna Fatima iswa aman*
who 3sf.say.PERF Fatima 3sm.drink.PERF water
‘Who did Fatima say drank water?’

Similarly, we expect to see both T-Agreement and C-Agreement in Object extraction contexts in Berber, since T will agree with the subject and C will agree with, for example, a wh-object. In other words we expect SHARE to be the only convergent option and to observe both subject-verb agreement and an obligatory Comp. These predictions are born out as shown in (39), (40), and (41).

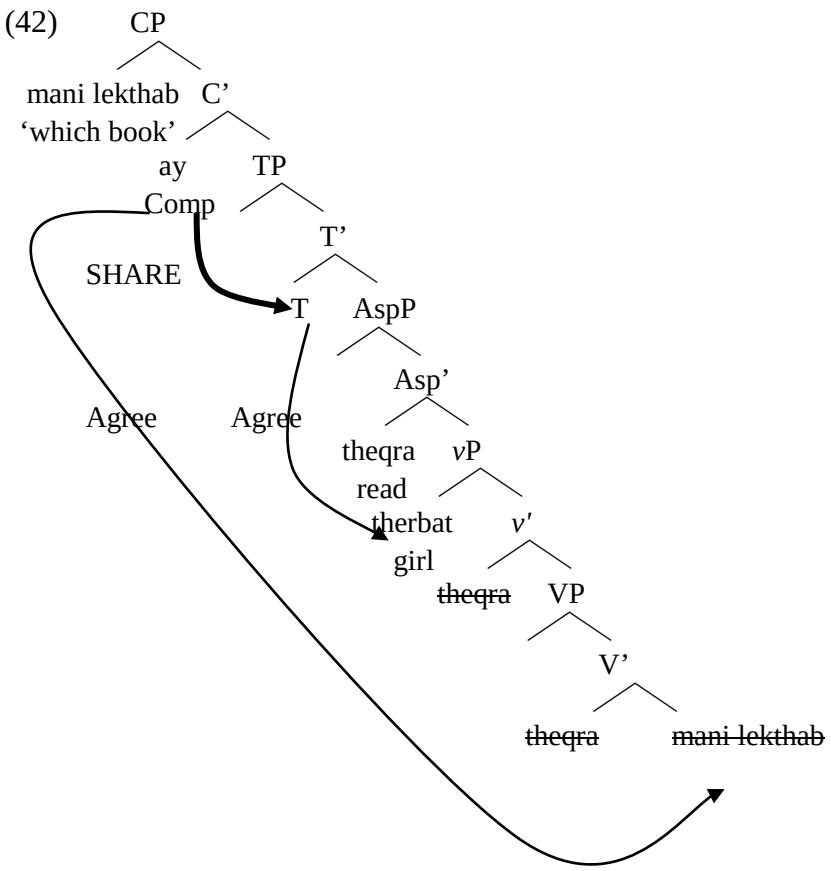
(39) *mani lekthab *(ay) theqra therbat*
which book *(Comp) 3sf.read.PERF girl
‘Which book did the girl read?’

(40) *lekthab-a *(ay) theqra therbat*
book-this *(Comp) 3sf.read.PERF girl
‘It was this book that the girl read’

(41) *lekthab *(ay) theqra therbat ur-ighuda*
book-this *(Comp) 3sf.read.PERF girl Neg-1sm.good
‘The book that the girl read is not good’

The example in (39) is an object wh-question, (40) is an object cleft-construction and (41) is an object relative clause. As shown in all these cases, Comp or C-Agreement is obligatory as expected if we consider the derivation of (39) represented in (42) below.

(42)



As shown in (42), we have a case of SHARE. Before we detail the analysis let us ask the question of what happens if we apply DONATE and KEEP? If DONATE applies C will transfer its φ-features to T, and C will cease to be active. T will probe the subject and T-Agreement will be achieved, yet the [-valued] [-interpretable] wh-feature on the object will not be valued and deleted and the derivation will ultimately crash. If, on the other hand KEEP applies, C will not transfer its φ-features to T, which means it will remain active and probe the closest active DP. The subject in Spec-*v*P is the closest goal to C, and since C is φ-complete it will agree with the subject and value its case; the φ-features on C should conversely get valued and deleted. The same problem arises again here and that is

the wh-feature on the wh-object will fail to get valued and deleted and the derivation will yet again crash. With SHARE, the derivation proceeds as follows: C transfers its φ-features to T and keeps a copy. C and T are both active; T probes the closest goal i.e. the subject, and as a result T-Agreement is obtained as marked by the subject-verb agreement, and C probes the closest active DP which is now the wh-object, since the subject has been inactivated by T. C-Agreement is then obtained as marked by the obligatory Comp. This is another compelling evidence for the different φ-Transfer options that I have discussed so far namely: DONATE, KEEP, and SHARE.

6. DONATE, KEEP and SHARE and their order of application in Crash Proof Syntax

As I pointed out at the beginning of this article, DOANTE, KEEP and SHARE are ordered in terms of principles of economy, computation efficiency and minimal search. One alternative approach would be not to complicate the rule system by, what seems like, "stipulating" the ordering and to let some of the empirical burden fall on the bare-output conditions namely feature interpretability at the interfaces. The application of these operations would be "free" and only derivations that meet bare-output conditions will ultimately converge. This requires derivations to crash. If one takes Crashproof Syntax seriously, crashing is not computationally efficient therefore undesirable according to Frampton and Gutmann. Berber facts provide evidence for ordering of application of DONATE, SHARE and KEEP, and indirect evidence for Crashproof Syntax. As I argued in the previous sections, evoking one mechanism over another is due to AC requiring no crash because the derivations never reach Spell-Out. The evidence of ordering comes mainly from the Anti-Agreement cases such as (23) repeated in (43).

(43)	*mani thamttut*	*ag*	*ʕlan*	*araw*
	which woman	COMP	see.PERF-Part	boys
	'Which woman saw the boys?'			

If we consider the derivation of the sentence above we notice that both KEEP and SHARE should be convergent. Before I elaborate on this point, recall that DONATE was not a viable option because if C does not keep φ-features it will eventually not value the wh-feature of the subject and the derivation will not be spelled out. What happens if KEEP applies? As I discussed in detail in the previous sections, C will have φ-features and will therefore be active, it will probe the closest active goal namely the wh-subject. C, by virtue of being φ-complete, will be able to value the case feature of the latter, and since it is also specified for a wh-feature it will value the wh-feature on the subject. Alternatively, if SHARE applies both C and T will have φ-features, hence both will be active. T will probe the subject, being φ-complete, it will value the subject's case feature and will get its own φ-features valued and deleted; as a result T-Agreement should obtain. The wh-feature on the subject is however still unvalued and the subject therefore should still remain active and visible to the still active C. C should probe the subject, the φ-features on C should get valued and deleted and so does the wh-feature on the subject and as a result C-Agreement should obtain. As we can see both KEEP and SHARE are convergent options, but only KEEP is empirically attested as shown by (44) vs. (45).

(44)	*mani thamttut*	*ag*	*ʕan*	*araw*
	which woman	COMP	see.PERF-Part	boys
	'Which woman saw the boys?'			
(45)	**mani thamttut*	*ag*	*thʕa*	*araw*
	which woman	COMP	3sf.see.PERF	boys
	'Which woman saw the boys?'			

As we can see, (45), where both C-Agreement and T-Agreement are marked, is ungrammatical, whereas, (44) where only C-Agreement is marked, is grammatical. This may confirm that the ordering of DONATE, KEEP and SHARE follows naturally from principles of economy. In declarative sentences, C does not have any left-periphery feature and neither does the subject. KEEP seems to be,

naturally, the first option given that T is closer to the subject than C. As soon as all the probes and the goals are rendered inactive the derivation is transferred to Spell-Out. In wh-questions and other subject extraction cases, C possesses a left-periphery/"discourse" feature and so does the subject, it seems "natural" that applying KEEP, an operation, that requires only one Probe-Goal relation to value and delete all the uninterpretable features of both the subject and C, would be preferred over an operation, namely SHARE, that requires two probe goal relations, hence two Agree operations, between two different probes i.e. C and T and the same goal namely the subject. Also, it seems natural that SHARE only applies when T and C probe two different goals as is the case in Long-distance extraction and in object wh/cleft/relative clauses. I therefore conclude that the ordering is both theoretically and empirically motivated and is compatible with Crash Proof Syntax:

Conclusion

I argued that the three feature inheritance mechanisms proposed in Ouali (2006, 2008) namely DONATE, KEEP, and SHARE are "ordered" naturally under principles of efficient computation i.e. economy and "Minimal Search", with (a) DONATE being the most "economical", and (c) SHARE being the last resort and least "economical". Ordering however is not induced by derivation crash. As pointed out by Frampton and Gutmann (2002), derivation crash is not computationally efficient, otherwise there will be no advantage of an ordered system over a "free" system. I showed that AC plays a crucial role applying one feature inheritance mechanism over the other before a derivation reaches Spell-Out.

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[1] See Boskovic (2007) for a detailed discussion.

[2] See Richards (2007) for compelling arguments for Features Inheritance as a conceptual necessity.

[3] However, see Stroik 2000; Starke 2001; Fitzpatrick 2002; Stroik 2008; Putnam & Stroik (forthcoming), and Putnam (this volume) among others for arguments against Probe-Goal Agree.

[4] A reviewer points out that anyone who does not make use of extremely local relation has to explain how their system fits within a crash-proof framework, especially one that eliminates all look-back and look-ahead mechanisms. I refer the reviewer to Frampton and Gutmann (2002) where Agree plays a major role in their system.

[5] See Hiraiwa (2001) for a different view according to which both C and T can enter in an Agree relation simultaneously (Multiple Agree).

[6] Notice that this assumption is very crucial and seems to be unavoidable. If we reverse the situation and assume that C bears a [-interpretable] wh-feature whereas the wh-word bears a [+interpretable] wh-feature, the feature on C will not get valued. Why? Because T, having received φ-features from C will probe the wh-subject and Agree with it. After this takes place the wh-subject becomes inactive because the only feature that made it active was the unvalued case. C will not get its wh-feature checked and the derivation will crash.

[7] I use the word participle (Part) to gloss the impoverished form of agreement marking AAE, following Ouhalla (2005b).