

On Shifting the Target in an Argumentative Discourse

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Abstract. Modeling of argumentative discourses and reasoning about the underlying driving forces is mostly done for a specific target, such as a case at the court or a dispute about a badly needed resource. In some settings, it may be possible and also preferable under certain circumstances to change the originally chosen target, but this issue is widely neglected in research about argumentation. In this paper, we examine conditions under which shifting the target in an argumentative discourse can be expected to be beneficial, and we sketch a model that captures essential concepts underlying such target shifts. Major ingredients are acceptability conditions of target alternations, judging the benefit of the target in focus, and considerations of discourse coherence. In elaborated versions, this model should have the potential of substantially improving the repertoire of argumentative agents in tasks such as resource allocation and product selling.

1 INTRODUCTION

In computational models of natural argument, modeling of a dispute and reasoning about the driving forces underlying it is mostly done for an externally given or initially chosen target which persists over the entire discourse. Such a constellation is certainly appropriate for tasks such as legal reasoning, where a case at the court is at stake, and any change in the accusation would lead to the end of this case, which may later be re-opened in a modified form. This is quite in contrast to other kinds of argumentative situations, such as disputes about resources and product selling in a shop, hence negotiations of some sort. In such settings, it may be possible and also preferable under certain circumstances to change the originally chosen target, but this issue is widely neglected in research about argumentation.

In this paper, we address the issue of shifting the target of argumentation. We examine conditions under which shifting the target in an argumentative discourse can be expected to be beneficial, including possible kinds of such changes, and we sketch a model that captures essential concepts underlying such target shifts. Major ingredients are acceptability conditions of target alternations, judging the benefit of the target in focus, and considerations of discourse coherence.

This paper is organized as follows. First, we motivate our approach by discussing argumentative situations where target shifts turn out to be essential. Then we elaborate conditions under which target shifts are possible and can be expected to improve the argumentative situation, including suitable dialog moves for achieving this purpose. Next, we sketch an operationalization of the underlying concepts. Then we illustrate our model by a sketch of an example. Finally, we discuss the role of this work and we indicate directions for future developments.

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2 MOTIVATION

The following dialog between a customer (C) and a travel agent (T) is a somehow streamlined version of a conversation I had on a conference and holiday trip in Australia two years ago:

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- (1) C: Hello, my name is H. I have booked the tour to the goldrush town including buffet dinner, starting soon.
 - (2) T: Hello, Mr. H. We have already tried to contact you. We are very sorry to tell you that this tour had to be canceled due to insufficient number of participants.
 - (3) C: Oh, what a pity, I expected this trip to be very nice.
 - (4) T: Will you stay for some time in Melbourne or other Australian cities? We could offer you another tour in exchange for the one you have booked. We would indeed appreciate doing so, since you have booked your tour with our US sister company, and we are therefore not able to give you cash refund.
 - (5) C: I will leave Melbourne soon, but I will spend a couple of days in Sydney later on.
 - (6) T: We have a large tour programme in Sydney, including a variety of city tours. Would you like to join one of these?
 - (7) C: Not so much. I have already been there, and I intend to explore some more places in the city on my own.
 - (8) T: We also have a number of day excursions, including a tour to the Blue mountain area. This landscape is really gorgeous, you will like it. This is also a very popular tour so we can guarantee that it will not be canceled. We offer this trip in several variants, and in combinations with visits to other places. Please have a look at our brochure.
 - (9) C: I would prefer the variant without lunch, including the animal park visit. But the price seems to be considerably less than what I have paid for the other tour.
 - (10) T: Right, you have paid in US Dollar, and all the prices in the brochure are in Australian Dollars. What about a small excursion in addition to the Blue mountain tour? Later this afternoon, we go to the beach, watching the penguins moving out of the water at sunset. This is a very spectacular nature trip and it is quite unique.
 - (11) C: I have never seen such an environment before. That sounds like good use of the remaining time of the day.
 - (12) T: Ok, Sir, I am glad that we came to a satisfactory deal. Let me do the booking, and I will give you vouchers for both tours in exchange for the canceled one.
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Figure 1. Argumentative dialog about alternative tour bookings

In this dialog, utterances (1) to (4) state the problem, followed by an informative request. The response (5) motivates the travel agent to make an offer (6), which includes several options. Since the reaction of the customer is not very appealing (7), the travel agent proposes a target shift, substituting day trips for the city tours, and the agent argues in favor of a specific subset (8). Then the customer expresses considerable interest, but raises the problem of insufficient money value of the proposed tour (9). To encounter this, the travel agent again proposes a kind of target shift, by building a pair of tours on the basis of the excursion just proposed and estimated well (10). This enhanced proposal is accepted by the customer (11), so that the travel agent can proceed with performing the booking and issuing vouchers (12).

This dialog demonstrates that flexibility in choosing a target object in an argumentative discourse, that is, changing it according to evidence collected in the course of the conversation, may be essential to reach the underlying goal, especially in a selling context. Hence, it is surprising that this concept has not been adopted in approaches to argumentation in such situations, as exemplified by work on the project NECA [6], which was about virtual agents engaged in a dialog about car selling. Admittedly, the emphasis in this project was on other research issues, such as guiding natural dialogs and adequate behavior of the virtual agents. The selling task itself was a bit underrepresented: an initial choice of a car as a selling object was made, and the best still available argument in favor of the chosen car was raised, one after the other. Even if the customer did not show enthusiasm when confronted with several appealing properties attributed to the chosen car, the initial selection was maintained over the entire conversation. A different strategy in presenting candidate objects in a selling situation was chosen by Carenini and Moore [4] for the housing domain. Instead of arguing about a single object, a limited set of promising candidate houses is chosen, and they are compared and contrasted in terms of how they meet the specifications of the customer. As with the car selling environment, there is no change of the original selection, but the emphasis is clearly on presentation techniques rather than on target adaptation over the course of a dialog.

In the dialog exposed in Figure 1, we have seen that there are two kinds of alternations of the target of the conversation: first, the target has been replaced, that is, another tour was offered; second, an aggregation was made by enhancing the tour proposed with another one. Indeed, there is also a third kind of alternation, which manifests itself in the well-known negotiation about an egg or a small set of eggs, with two agents arguing in favor of using the egg or all eggs for their own purpose. As long as both agents only put forward arguments that emphasize their own priority in this dispute about the limited resource, the case tends to remain undecided. However, if the agents somehow address the purpose for using the egg(s), and they discover that one of them only needs the egg yolk and the other one the egg white, the dispute can be resolved quite nicely by simply partitioning and distributing the target in such a way that the needs of both parties are met satisfactorily. In the following, we address specificities of each of these kinds of target shift, and we develop a methodology for initiating suitable target shifts in the context of an argumentative dispute.

3 CONCEPTS INVOLVED IN TARGET SHIFTS

As the discussion in the previous section has shown, target shifts in argumentation may be beneficial and even essential in an argumentative discourse but, by and large, they do not occur too often. Hence, certain circumstances must be present under which a target can be reasonably initiated, which comprise:

- Constraints which must be met to make a target shift applicable at all; in part, these constraints differ according to the kind of shift, as distinguished in the previous section.
- Conditions which make a target shift in some sense promising with respect to approaching the goal of the conversation.
- Dialog moves which initiate a target shift or explore circumstances under which such a shift is likely to be beneficial.

We discuss each of these concepts in turn.

The applicability constraints essentially express whether the target object and the substitution candidate or candidates considered are compatible in their purpose of use. In order to express this properly, choosing the right degree of precision required for this specification may be quite delicate. For example, an excursion trip may be changed into another one, provided time and location relations are satisfactory according to the given circumstances. Similarly, a dish order in a restaurant can typically be changed into another one with some minor restrictions. In contrast, an egg may possibly be replaced by its usable parts, but not by any other food ingredient, while a fish typically may be replaced by another one with similar flesh properties. In many cases, the description of this purpose must be more precise than the specification found under the TELIC role in Pustejovsky's Generative lexicon [7], which expresses the purpose or function of an object, thus enabling or at least supporting the interpretation of expressions containing metonymic relations. In addition to these general constraints about reasonably applicable substitutions, some specificities concern the substitution of a target object by its parts and the composition of several target objects. Making parts of a target the target itself must enable the maintenance of the target's purpose, at least in some restricted form, and carrying out the partitioning action must be compatible with this purpose. For example, cooking with egg white or egg yolk only is still meaningful for certain kinds of dishes, while driving requires the entire car. However, partitioning an egg into its usable parts only works in the kitchen where the cooking will take place, and not in the supermarket. Finally, building compositions of target objects must have some extra value, which is the case for a set of well-timed excursion trips. For cars, offering a pair of a sports car and a small city car instead of a standard car would be eccentric and thus not well-justified. Hence, elaborating these constraints appropriately means expressing a good deal of real-world knowledge for the intended domain of application.

We next consider conditions under which initiating a target shift appears to be promising. Even if the substitution of the target object is considered possible, this does by far not mean that such an operation is also a desirable step in the argumentative process. We consider at least three criteria to be influential for motivating a target shift:

- The target currently considered must have lost somehow in its estimated suitability over the course of the preceding discourse in comparison to the assessment which caused this object to be chosen as the target of the argumentation.
- There must be other candidates, a partitioning of the present target object into its useable components, or a combination with some other target objects so that they are either considered superior in the meantime or would potentially be considered superior in dependency of some yet unexplored factors, such as the precise cooking intention, when partitioning the egg into white and yolk is of potential interest.
- The “progress” over the last series of dialog moves regarding the assessment of the target object in question turned out to be neglectable. If this is the case, a change in the strategy looks like a promising alternative. However, it is generally advisable to maintain the target object over some sequence of dialog moves, for reasons of coherence. A quick shift might only be justified by the raise of “killer” arguments, which cause a substantial shift in assessing the target object.

Finally, we turn our attention to possible dialog moves by which a target shift is initiated. There are a few options in terms of dialog moves which aim at shifting the target of the argumentation. We consider the following three alternatives:

- The most straightforward option is to directly propose another target object, which may be a single object or a set of related objects, among which the other conversant is intended to make a choice, if the proposed set is considered to be appropriate. An example for introducing such a set of related options is utterance (8) in the dialog in Figure 1. An example for proposing a specific new target is utterance (10), which builds a combination of the present target with a new one.
- A more flexible variant is a kind of generic proposal about a target shift. Moreover, such a proposal could also be formulated in a manner which can be seen as some sort of intermediate form ranging between a generic proposal and the form described under the previous item of this bullet list: in such a case, the proposal to shift the target would come with a description of potential new targets, similar to the initial proposal (6) in the motivating dialog in Figure 1.
- The last variant of approaching a target shift lies in exploring the preconditions for such a shift, that is, asking for information which is crucial for determining the suitability of a target shift and for an appropriate choice among the available candidates. The inforamatory request (4) in the motivating dialog in Figure 1 is an example for such a dialog move.

In the following, we try to make these concepts a bit more precise. We give formal descriptions which capture essential concepts in the acceptability and desirability of target shifts in an argumentation. These descriptions are intended as an interface between an argumentation framework and an elaborate domain model, which feeds these descriptions so that they can be instantiated or evaluated in a given situation. Based on these descriptions, criteria are formulated which express whether or not a target shift appears to be appropriate, and by which means that can be addressed.

4 A SKETCH OF A FORMALIZATION

In order to formalize argumentative situations where target shifts are initiated, we distinguish the following four components (Concepts and functions used can be found in Tables 1 and 3):

- Properties of the argument environment per se
- Domain predicates that express properties of the domain that are relevant for reasoning about potential target shifts
- Rules expressing the suitable applicability of a target shift, on the basis of the state of the argumentative discourse and the situation-relevant segment of domain specificities
- Rules expressing specifications of dialog moves initiating a target shift, on the basis of all the three factors above

For defining key parts of an argumentative environment, we need a non-empty set of target candidates $Target = \{t_1, \dots, t_n\}$, one of which is the current target t' . In addition, there is a function $Assess$, which assigns a potential benefit to each of these candidates, in the sense of utility for the agent in question. This function may change its values in accordance with increasing evidence or assessments collected in the course of the argumentative discourse; in particular, $Assess(t')$ may be subject to changes. We assume that $Assess(t') \geq Assess(t)$ for all $t \neq t'$, $t_i \in Target$, at the time when t' was picked, but not necessarily at later stages in the argumentative discourse. The argumentative discourse, finally, is conceived as a sequence of dialog moves $\langle move_1(t_1), \dots, move_n(t_n) \rangle$, with some target t_i being the topic in move $move_i$.

The domain predicates are focused on the issue of potential target shifts. They essentially comprise two factors:

- the situational purpose of an object, and
- ways of decomposing an object resp. composing objects

The purpose $Purpose(t,s)$ of an object t is defined for a situation s , which may be different from the purpose ascribed to t in another situation s' , but it does not vary within a single argumentative discourse. In this context, we treat situations as a kind of activity, which may be restricted by location and time constraints. In addition, there is a specialization relation between purposes: $Purpose(t,s) > Purpose(t',s')$ means that the purpose ascribed to t' in situation s' is a specialization of the purpose ascribed to t in situation s . For example, we may have $Purpose(egg,cooking) = cooking-with-egg$, $Purpose(egg-white, cooking) = cooking-with-egg-white$, and $Purpose(egg-yolk, cooking) = cooking-with-egg-yolk$ and, since the purpose is maintained, we have for the parts $cooking-with-egg > cooking-with-egg-white$ and $cooking-with-egg > cooking-with-egg-yolk$. In order to express compositions and decompositions, we define:

- a function $Parts(t)$ which yields a list of components of t , if that object is considered as being decomposable
- a function $Partitioning(t,s',s)$ which yields a set of constraints under which decomposing object t in its parts in situation s' is consistent with $Purpose(t,s)$. For cooking purposes, a $Partitioning(egg,kitchen,Purpose(egg,cooking))$ yields an empty set of constraints, whereas for $Partitioning(egg,x,Purpose(egg,cooking))$, which cannot be achieved in general, the constraint $x > kitchen$ is obtained.

Table 1. Concepts used in the formalization

Objects	Description
<i>target</i>	an object which is argued about
<i>move(target)</i>	a dialog move, where <i>target</i> is the topic
<i>situation[(l,t)]</i>	an activity, optionally contextualized

- a function *Compatible*(t,t',s,s') which yields a set of constraints under which the objects t and t' can be used for the purpose *Purpose*(t,s) in their respective situations s and s' .
- a function *Combinable*(t,t',s,s') which yields a set of constraints under which the objects t and t' can both be used by the same agent in their respective situations s and s' .

The functions *Partitioning*, *Compatible*, and *Combinable* are a bit more specialized than mere logical functions. Under certain circumstances they produce constraints which express conditions under which the function yields true as its value. These constraints may refer to the purpose or to circumstances of the situation which appear as arguments in the function calls. For example, *Compatible*(*egg,egg-white,kitchen,kitchen*) yields the constraint *cooking-with-egg* \rightarrow *cooking-with-egg-white* which means that the purpose of using the egg must be made more specific to ensure compatibility. In contrast, *Compatible*(*egg,fish,kitchen,kitchen*) would simply yield false, since *cooking-with-egg* and *cooking-with-fish* cannot be unified. Moreover, *Compatible*(*trip₁,trip₂,situation₁,situation₂*) would yield constraints that make the target shift practically manageable, so that *time*(*situation₁*), *time*(*situation₂*), *location*(*situation₁*), and *location*(*situation₂*) are related in a way that gives a suitable time difference and reasonable local vicinity. The function *Combinable* may yield the same or converse constraints as the function *Compatible* does, in dependency of the category of the situation. For example, cooking with two different items can and should be accomplished in the same situation, whereas participating in two trips requires some time difference between the two trips, depending on the distance between the places where the trips take place.

On the basis of these definitions, we can formulate suitability conditions for a target shift *Target_Shift_Feasible*(t,t',s,s'). The definitions are distinguished according to the category of shift:

- 1) A *simple replacement* of target t by target t' :
Target_Shift_Feasible(t,t',s,s')
 If *Compatible*(t,t',s,s') yields true (no constraints), then t' can potentially become the new target instead of t ; if *Compatible*(t,t',s,s') yields some constraints, checking their satisfiability is the prerequisite for the target shift (replacing t by t').
- 2) A *partitioning* of target t into its components:
Target_Shift_Feasible($t,\{t_1 \dots t_n\},s,s$)
 If *Parts*(t) = $\{t_1 \dots t_n\}$, and *Partitioning*(t,s',s) and *Compatible*(t,t_i,s,s') hold for at least some i , then t' 's components $\{t_1 \dots t_n\}$ can potentially become the new targets instead of t .
- 3) A *composition* of the current target with another one:
Target_Shift_Feasible($t,\{t,t'\},s,s$)
 If *Combinable*(t,t',s,s) yields true (no constraints), then t' can potentially join t as the target; if *Combinable*(t,t',s,s) yields some constraints, the consequences is analogous to case 1.

Table 2. Functions used in the formalization

Functions	Description
<i>Assess</i> (t')	assesses the value (utility) of target t
<i>Purpose</i> (t,s)	yields the purpose of target t in situation s
<i>Parts</i> (t)	yields the components of t if decomposable
<i>Partitioning</i> (t,s',s)	yields constraints under which decomposing object t in situation s' meets <i>Purpose</i> (t,s)
<i>Compatible</i> (t,t',s,s')	yields true if the two objects t in s and t' in s' can both be used for the purpose <i>Purpose</i> (t,s)
<i>Combinable</i> (t,t',s,s')	yields true if the two objects t in s and t' in s' can both be used by the same agent
<i>Target_Shift_Feasible</i> (t,t',s,s')	yields true if shifting from t in s to t' in s' is consistent (t' can also be a set of objects)
<i>Target_Shift_Beneficial</i> (t,t',s,s')	yields true if shifting from t in s to t' in s' is also considered beneficial in the dialog
<i>Thresh</i> (t,t',N)	yields true in dependency of <i>Assess</i> (t) and <i>Assess</i> (t') and N (moves without topic shift)

On the basis of that, we can formulate conditions on whether or not a shift of the target appears to be beneficial (*Target_Shift_Beneficial*(t,x,s,s') is true). Expressing this criterion is supported by the function *Thresh*(t,t',N), which combines assessment differences among the target candidates as well as past changes in the discourse topic ($|\langle move_{i,j,n}(t) \rangle|$ being the number of dialog steps with topic t , going back from the current step n):

- 1) A *simple replacement* of target t by target t' :
Target_Shift_Beneficial(t,t',s,s')
Target_Shift_Feasible(t,t',s,s') yields no constraints and *Thresh*($t,t',|\langle m_{i,j,n}(t) \rangle|$) holds.
- 2) A *partitioning* of target t into its components:
Target_Shift_Beneficial($t,\{t_1 \dots t_n\},s,s'$)
Target_Shift_Feasible($t,\{t_1 \dots t_n\},s,s'$) with *Parts*(t) = $\{t_1 \dots t_n\}$ yields no constraints and *Thresh*($t,\{t_i\},|\langle m_{i,j,n}(t) \rangle|$) holds.
- 3) A *composition* of the current target with another one:
Target_Shift_Beneficial($t,\{t,t'\},s,s$):
Target_Shift_Feasible($t,\{t,t'\},s,s$) yields no constraints and *Thresh*($t,\{t,t'\},|\langle m_{i,j,n}(t) \rangle|$) holds.

Finally, if *Target_Shift_Beneficial*(t,x,s,s') holds for some x , a topic shift is likely to bring the state of the argumentation forward. Two principled alternatives may initiate a target shift:

- 1) *Propose*(*Target-shift*(t,x)), $x \in \{t',\{t_1 \dots t_n\},\{t,t'\}\}$:
Target_Shift_Beneficial(t,x,s,s') and if *Target_Shift_Beneficial*(t,y,s,s') holds, then *Assess*(t,x,s,s') \gg *Assess*(t,y,s,s').
 - 2) *Propose*(*Target-shift*($t,?$)):
Target_Shift_Beneficial(t,x,s,s') holds for several x , and there is no y such that *Assess*(t,y,s,s') \gg *Assess*(t,x,s,s').
- In addition, if *Target_Shift_Feasible*($t,\{t,t'\},s,s$) yields a set of constraints that do not contradict the present state of affairs, there is a further possibility to initiate a target shift:
- 3) *Inquiry*(*property*(x)), $x \in \{t',\{t_1 \dots t_n\},\{t,t'\}\}$
 where the value of *property*(x) is likely to solve one of these constraints, and *property*(x) addresses the user's preferences.

Table 3. Changes in assessing of potential targets in the dialog

Move	target'	Assess(t_1)	Assess(t_2)	Assess(t_3)	Assess(t_2+t_3)
(6)	t_1	152	152	38	190
(8)	t_2	88	152	38	190
(10)	t_2+t_3	88	120	38	158
(11)	t_2+t_3	88	120	40	160

5 REVISITING THE EXAMPLE

In this section, we reconstruct a part of the dialog exposed in Figure 1 on the basis of the model developed in the previous section. In doing so, we make several assumptions and simplifications to enable a concise focus on issues of topic shifting. The purpose is identical for all potential targets, and we also abstract from time and location, since most tours in question operate on a daily basis, so that computing compatibility and composability of trips is not problematic. Moreover, partitioning of trips is devoid of sense, which reduces our repertoire of looking for alternative targets. Altogether, these simplifications reduce considerations about the whether or not a target shift is feasible and beneficial to computations on the basis of changes in the *Assess* function values of the set of potential targets.

In order to reconstruct the portion of the dialog in Figure 1 after the first target has been offered (6), we assume that the *Assess* function is based on the difference of the money values between the canceled tour and the target and on the degree to which the customer likes the target. For the latter, we just use a coarse-grained scale with the three values $\{good, bad, unknown\}$, which is sufficient for the dialog fragment addressed. The proper assessment consists of two perspectives: from the travel agents side, only the difference in money value is of interest. From the perspective of the customer, he should also like the tour or tours that make up the target. Hence, the best target is the best approximation in money value that the customer likes. In order to incorporate both perspectives, the function *Assess* uses the money value difference for the travel agent's view, and adds this value to the money value difference that is weighted by the degree of the customer's liking. Weights for *good*, *bad*, and *unknown* are 1, 0.1, 0.9, respectively. Furthermore, we assume that single tours are offered prior to combined tours, in order to inquire whether or not the customer likes a tour, and that popular tours are offered first. Finally, *Thresh* is assumed to be true if the current target is assessed worse than another potential target by 20% after the first dialog move, 4% less for each of the three subsequent dialog moves. In concrete numbers, we assume that the canceled tour costs 160\$, Sydney city tours between 50\$ and 160\$ (t_1), Blue Mountain tours between 100\$ and 160\$ (t_2), and the Penguin tour 40\$ (t_3). For value ranges, the most suitable value is taken.

In (6), the target t_1 (most popular tour in Sydney) is chosen as a first offer. (7) causes a drop in the assessment of this tour, so that the other popular candidate t_2 is offered (8). The response (9) narrows the scope of the value range of that tour, which again leads to a drop in its assessment. Since this change is substantial, a tour combination is offered next (10), which is accepted. The changes in the values of *Assess* are summarized in Table 3.

6 CONCLUSION AND DISCUSSION

In this paper, we have addressed the issue of shifting the target of argumentation. We have examined conditions under which shifting the target in an argumentative discourse can be expected to be beneficial, including possible kinds of such changes, and we have sketched a model that captures essential concepts underlying such target shifts. Major ingredients are acceptability conditions of target alternations, judging the benefit of the target in focus, and considerations of discourse coherence.

In some sense, our model complements mainstream research in argumentation systems in the following ways:

- A variety of assessments are handled in a more flexible manner, allowing incompleteness of knowledge and therefore changes over the course of a dialog. For example, [5] relies on an utility function known to all agents, where all objects are compatible due to the one-dimensional utility. In contrast, we distinguish among purposes that restrict the exchange of objects in a negotiation discourse.
- We have elaborated choices and preferences among dialog moves where other models [1, 2] provide only rules for assessing whether or not a dialog continuation conforms to consistency constraints or not.

Admittedly, our model is in a very earlier stage w.r.t. the work cited above. We would certainly profit from embedding our reasoning facilities into a argumentation-based framework, and by incorporating related efforts in assessing preferences, such as [3], which we intend to do in the near future. Further extensions concern various measures to put the formal model on more solid grounds: the incorporation of domain knowledge and reasoning about it is oriented on a new perspective that particularly focuses on assessments for potential target shifts, but it still appears to be adhoc in some places. Moreover, the formalizations of assessing shifting options in terms of their suitability and dialog moves that implement appropriate target shifts still contain some parts that need to be fleshed out in more detail.

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