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SEEING TO IT THAT AN AGENT FORMS A BELIEF

1. Introduction

To what extent, if any, is belief formation under our direct voluntary control? In the present paper, it is suggested that an understanding of ascriptions of an agent α's belief formation can be obtained by considering ascriptions of α's seeing to it that α has certain implicit beliefs. It will turn out that, contrary to what doxastic anti-voluntarists such as B. Williams have claimed, a consistent formal treatment of ascriptions of belief formation, understood as decisions to believe, is possible.

In the literature on doxastic voluntarism, usually a distinction is drawn between direct and indirect ways of belief formation, and the possibility of indirect belief formation is hardly ever questioned. It is certainly possible for an agent to decide to take a drug or to decide to perform certain actions intending or hoping that thereby she comes to believe a certain proposition. In other words, the agent acts, intending or hoping or assuming it to be probable that thereby a belief is caused. Indirect ways of belief formation are often mentioned only to set them aside from consideration and to focus on the question whether there exist direct ways of belief formation and, if so, how they can be represented. Also the present paper is not concerned with such indirect ways of belief acquisition. If an agent α is seeing to it that α believes that A, α is making a decision with the effect that a course of events is realized relative to which it is true that α believes that A. It is then in α's power to ensure that α believes that A, and α's believing that A is not the result of the choices of nature.

It seems that the notions of inducement of implicit beliefs and belief formation have received little formal treatment. In this paper an approach to doxastic logic is suggested that takes the formation of implicit beliefs as fundamental for defining explicit belief. The idea is to define first a semantics for ascriptions of the inducement of implicit beliefs, then to obtain from this as a special case a semantics for ascriptions of belief formation, and finally to use the notion of formation of implicit beliefs to define a semantics for ascriptions of explicit belief. The gain is manifold. First, the semantics is useful, because the notions of belief inducement and belief formation seem to be of intrinsic interest in the study of communication and in epistemology. Second, the notorious problem of closure of explicit belief under logical consequence is avoided not by postulating syntactic filters like awareness sets [7], [8] or non-standard possible worlds [14], [15], [16]. A semantical analysis is suggested such that neither inducement of belief, nor belief formation, nor explicit belief is closed under logical consequence, because the approach is based on a certain modal logic of agency that avoids the unwelcome closure property. This modal logic is a variant of the seeing-to-it-that Theory (stit Theory) developed and investigated in the first place by Belnap, Perloff, and Xu [2]. Third, in the proposed approach also neither the inducement of implicit group belief, the belief formation of groups, nor explicit group belief is closed under group membership. That is to say, if a group Δ of doxastic subjects voluntarily acquires the belief that A, that is, decides to believe that A, and $\alpha \in \Delta$, it does not follow that α acquires the belief that A. Failure of closure under group membership is a realistic property reflecting our actual practice of ascribing explicit group beliefs and formations of implicit group beliefs.

2. Doxastic obligations and doxastic voluntarism

In a scientific context, if an agent α claims to believe that A, and B can be shown to be deducible from A using a consequence relation accepted by α, then α is committed to form at least the implicit belief that B, in the sense of seeing to it that at every state compatible with what the agent implicitly believes, B is true. Moreover, if α refrains from forming the explicit belief that B, α is committed to abandon the belief that A. Although the question whether or not agents may be obligated to form or abandon beliefs is highly controversial, the idea that scientific beliefs, although they are, as a matter of fact, not closed under logical consequence, ought to be treated as if they were, seems to be well-supported by scientific practice. Thus, at least in a justificatory context, doxastic subjects can be made responsible for their belief formations. It is widely held that the assumption of doxastic obligations implies the thesis that belief formation is voluntary, that it is a matter of the will. In the literature on epistemology, the thesis that belief formation is voluntary, or rather the family of theses consisting of possible readings of that claim, is called doxastic voluntarism (or sometimes also volitionism).[1] As a rule (or at least often), in philosophy a belief is understood as a mental state of a doxastic subject. Moreover, usually it is assumed that these subjects are capable of agency. A belief has a content and the content of a belief is a proposition or a sentence expressing a proposition. Since propositions and sentences may be true or false (or sentences may be true or false on the strength of the propositions they express), also beliefs may be said to be true or false. In the philosophical literature, not always a distinction is drawn between implicit and explicit beliefs. If this distinction is made, then it is generally assumed that if α explicitly believes that A, α also implicitly believes that A. In [7] it has been suggested that "α explicitly believes that A" is read as "α implicitly believes that A and α is aware of A". Note that our conception of explicit belief will be different. On our conception, an agent α explicitly believes that A not if α's belief that A happens to be a conscious belief of α, or α is familiar with the proposition expressed by A. Rather α explicitly believes that A if α *has seen to it* that α implicitly believes that A (and since then did not give up the implicit belief that A). As a consequence, if the conception of implicit belief is such that certain formulas cannot but be implicitly believed, these formulas cannot be explicitly believed, since seeing-to-it-that requires alternatives.

A classical paper on the issue of doxastic voluntarism is the essay *The will to believe* by William James [11]. James argues that there are pairs of *genuine options*, pairs of hypotheses that are living, forced and momentous for a doxastic subject at a certain moment. An option is living if both hypotheses are live for the agent, meaning that the agent is ready to consider the hypotheses as contenders for belief at the moment in question. An option is forced if both hypotheses can neither both be true nor both be false, and it is momentous if the choice between the hypotheses presents a unique, irrevocable opportunity for the subject with important consequences for the subject. The class of genuine options of a doxastic subject at a given time will include certain religious claims and self-creating beliefs and their negations.

[1] Audi [1] distinguishes between behavioral and genetic voluntarism, where behavioral voluntarism is the view that believing is an action type and genetic voluntarism is the view that *belief formation* is an action type. According to Audi [1, p. 100] behavioral voluntarism "is a clear failure", and in the opinion of Engel [6] it is absurd.

Whereas for James it is not only possible but lawful that an agent decides to believe if confronted with a genuine option, other philosophers doubt that it is possible that there is an agent α and a sentence A such that α decides to believe that A. According to Williams [19] a voluntary belief acquisition or belief formation is impossible for conceptual reasons, and in Pojman's opinion [13] the assumption that voluntary belief acquisition is possible exhibits an incoherence comparable to the incoherence of the Moore paradox. Williams argues as follows:

> If I could acquire a belief at will, I could acquire it whether it was true or not; moreover I would know that I could acquire it whether it was true or not. If in full consciousness I could will to acquire a 'belief' irrespective of its truth, it is unclear that before the event I could seriously think of it as a belief, i.e. as something purporting to represent reality. At the very least, there must be a restriction on what is the case after the event; since I could not then, in full consciousness, regard this as a belief of mine, i.e. something I take to be true, and also know that I acquired it at will. With regard to no belief could I know - or, if all this is to be done in full consciousness, even suspect - that I had acquired it at will. But if I can acquire beliefs at will, I must know that I am able to do this; and could I know that I was capable of this feat, if with regard to every feat of this kind which I had performed I necessarily had to believe that it had not taken place? [19, p. 148]

Cook [5], for example, claims that "Williams has persuasively argued that our inability to believe at will is not a contingent fact". The present author [17], [18] has argued that both Williams's and Pojman's arguments fail, see also [20]. Another failed attempt at developing a conclusive argument in favour of doxastic voluntarism is described in [3]. Our purpose here is not surveying all the arguments that have been proposed to show that deciding to belief is, necessarily or as a matter of fact, impossible. In the rest of this paper we shall show that there are semantical models in which ascriptions of the voluntary acquisition of implicit and explicit beliefs *can* be interpreted.

3. Belief inducement and inducement of belief formation

Let lowercase Greek letters denote single doxastic subjects assumed also to be agents, and let uppercase Greek letters denote finite sets of such agents. I shall propose evaluation clauses for the following notions:

[A] α sees to it that β implicitly believes that A (where $\alpha \neq \beta$)
[B] α sees to it that α implicitly believes that A
[C] α sees to it that α forms the implicit belief that A

Moreover, I shall comment on

[D] α sees to it that β forms the implicit belief that A (where $\alpha \neq \beta$)

There seems to be an agreement that the propositional logic of implicit belief, or the belief of completely rational, logically omniscient agents is the polymodal logic **KD45**, also known as **weak S5**. That is, for every agent α, "α implicitly believes that A" may be translated as $B_\alpha A$, where B_α is a **KD45** necessity operator. This is one of the fundamental contributions, Jaakko Hintikka has made to doxastic logic. As is well-known, the intuitive underpinning Hintikka [9] suggested is as follows: $B_\alpha A$ is true at a state u if and only if A is true at every doxastic alternative for α at u, that is, at every state compatible with what α (implicitly) believes at u. Such ascriptions of implicit belief are non-agentive, because A being true at every state compatible with what α believes at u clearly fails to describe a concrete action. Expressions [A] – [C] are agentive. In stit Theory several notions of seeing-to-it-that have been investigated. The general idea is that if α sees to it that A, then α makes a choice ensuring that A is true, and A might have been false, had α made another choice. In the semantics of the dstit operator it is assumed that the agent's choice is made at the index of evaluation. Combining the dstit semantics for "seeing to it that" with the relational possible worlds semantics for **KD45**, we obtain a formal semantics for [A] interpreted as [α *dstit*: $B_\beta A$] ("α deliberatively sees to it that β implicitly believes that A") and [B] interpreted as [α *dstit*: $B_\alpha A$]. My suggestion is to read [B] as "α forms the implicit belief that A", so that we can understand [C] as "α sees to it that [B]". According to the stit Normal Form Thesis, a sentence C agentive just in α is equivalent with [α *dstit*: C]. Therefore, since [α *dstit*: [α *dstit*: A]] is logically equivalent with [α *dstit*: A], [C] and [B] are logically equivalent.

Note, however, that we are not justified in interpreting [D] as "α sees to it that [A]", for we have to distinguish between α inducing β's implicit belief that A ([α *dstit*: $B_\beta A$]) and α seeing to it that β forms the implicit belief that A ([α *dstit*: [β *dstit*: $B_\beta A$]]). Moreover, as we shall see, the semantics of *dstit* is such that a formula [α *dstit*: [β *dstit*: C]] will never be evaluated as true. This seems to be in conflict with everyday discourse. Chellas [4] regards it as "bizarre to deny that an agent should be able to see to it that another agent sees to something". On closer inspection, this fact is less counterintuitive. On the contrary, it is even plausible, if agents are assumed to be independent of each other. If it were in α's power to *ensure* at a moment m that β sees to it that C at m, then β would not be independent in her choices from the

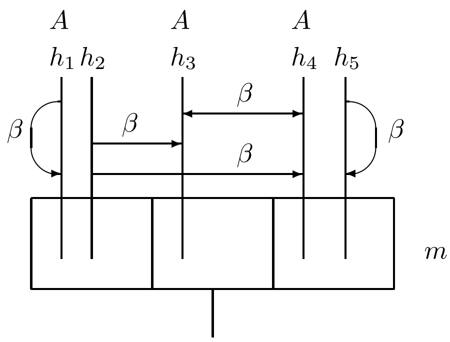

Figure 1. A simple example.

simultaneous choices possible to α. Of course, an agent α can act, intending or hoping that another agent β thereby is caused or lead to seeing to it that C, say, to forming the implicit belief that A. And if β indeed forms the implicit belief that A, it may happen that α is reported to have seen to it that β has formed the implicit belief in question. But this report would be misleading. Hopes may remain unfulfilled, agents may refuse to obey orders, etc. For a discussion, see also [2, Section 10B].

Let us recall the required definitions from dstit theory. A pair $\langle T, \leq \rangle$, is called a *branching temporal frame* if T is a non-empty set of moments, and $\leq$ is a partial order on T satisfying *historical connectedness* $(\forall m_1 \forall m_2 \exists m(m \leq m_1 \wedge m \leq m_2))$ and *no backward branching* $(\forall m \forall m_1 \forall m_2((m_1 \leq m \wedge m_2 \leq m) \supset (m_1 \leq m_2 \vee m_2 \leq m_1)))$. A *history in* T is a maximal set of moments (in T) linearly ordered by $<$, where $m < m'$ iff $m \leq m'$ and $m \neq m'$. The set of histories passing through moment m, H_m, is defined as $\{h \mid h \text{ is history and } m \in h\}$. Formulas are evaluated at moment/history pairs (m, h). We assume that our doxastic subjects are also agents who can influence the future course of events by their actions. For this purpose it is assumed that for every agent α the histories passing through a moment m are partitioned into sets of histories choice-equivalent for α at m. The idea is that at m, α cannot distinguish by her or his actions between histories that are choice-equivalent for α at m. These 'choice cells' represent the options available to α at m. It is required that for every agent α, histories dividing at a moment later than m are choice-equivalent for α at m.

If $\langle \mathrm{T}, \leq \rangle$ is a branching temporal frame, then $\langle \mathrm{T}, \leq, Agent, Choice \rangle$ is called a *dstit frame*, if *Agent* is a nonempty set (of agents) and *Choice* is a function mapping every agent/moment pair (α, m) to a partition of H_m (the histories *choice-equivalent for* α *at* m) satisfying *no choice between undivided histories* $(\forall H \in Choice(\alpha, m))\forall h \forall h'[(h \in H \wedge \exists m'(m < m' \wedge m' \in h \cap h')) \supset h' \in H]$. If $h \in H_m$, then $Choice^m_\alpha(h)$ is the particular choice in $Choice(\alpha, m)$ containing h. A *dstit model* is a structure $\langle T, \leq, Agent, Choice, v\rangle$, where $\langle T, \leq, Agent, Choice\rangle$ is a dstit frame, and v is a valuation function that interprets atomic formulas by sets of moment/history pairs. A complete axiomatization of dstit logic has been presented in [21].

A *doxastic dstit model* is a structure $\langle T, \leq, Agent, Choice, R, v\rangle$, where $\langle T, \leq, Agent, Choice, v\rangle$ is a dstit-model and $R = \{R^m_\alpha \mid \alpha \in Agent,\ m \in T,\ R^m_\alpha \subseteq H_m \times H_m\}$ is a set of serial, transitive and Euclidean relations.

The truth definitions for $[\alpha\ dstit\colon A]$ ("α deliberatively sees to it that A") and $[\alpha\ dstit\colon B_\beta A]$ ("α deliberatively sees to it that β implicitly believes that A") are as follows:

DEFINITION 1. $[\alpha\ dstit\colon A]$ is true in $\langle T, \leq, Agent, Choice, R, v\rangle$ at (m, h) iff (i) $\forall h' \in Choice^m_\alpha(h)$ A is true at (m, h'), and (ii) $\exists h' \in H_m$ such that A is not true at (m, h').

DEFINITION 2. $[\alpha\ \text{dstit}\colon B_\beta A]$ is true in $\langle T, \leq, Agent, Choice, R, v\rangle$ at (m, h) iff (i) $\forall h' \in Choice^m_\alpha(h)\ \forall h'' \in H_m$, if $h' R^m_\beta h''$ then A is true at (m, h''), and (ii) $\exists h', h'' \in H_m$ such that $h' R^m_\beta h''$ and A is not true at (m, h'').

In Figure 1, moment m is partitioned into three choice cells for α. Moreover, the R^m_β alternatives to the histories passing through m are depicted by annotated arrows. The formula A is true at the moment/history pairs $(m,\ h_1)$, $(m,\ h_3)$ and $(m,\ h_4)$. In this simple example, at $(m,\ h_2)$ it is true that α sees to it that β implicitly believes that A.

In Definitions 1 and 2, (i) is called the positive condition and (ii) the negative condition. It is the negative condition that prevents closure under logical consequence.

OBSERVATION 1. *Under the present analysis, the inducement of implicit belief and the formation (self-inducement) of implicit belief of single agents is not closed under logical consequence.*

Since for every agent x, $B_x\top$ is valid, no agent can *decide* to implicitly believe a valid formula; valid formulas are already implicitly believed. Let us now consider independence of agents. Belnap, Perloff, and Xu [2, p. 217] suggest expressing independence of agents by the following requirement.

Ind For every moment m and every function f_m on $Agent$ such that $f_m(\alpha) \in Choice^m_\alpha$ for all $\alpha \in Agent$, $\bigcap \{f_m(\alpha) \mid \alpha \in Agent\} \neq \emptyset$.

In other words, the intersection of two choice-cells is never empty. Under this assumption, a formula [α *dstit*: [β *dstit*: C]] fails to be true at any moment/history-pair.[2] Suppose to the contrary that [α *dstit*: [β *dstit*: C]] is true at (m, h). Then (1) [β *dstit*: C] is true at every $h_1 \in Choice^m_\alpha(h)$, and (2) $(\exists h_2 \in H_m)$ and [β *dstit*: C] is not true at (m, h_2). From (1) it follows that (i) $(\exists h_3 \in H_m)$ and C is not true at (m, h_3). From (2) it follows that either (ii) C is settled true at m (true at every (m, h) with $h \in H_m$), or (iii) there is a history $h_4 \in Choice^m_\beta(h_2)$ such that C is not true at (m, h_4). If we assume (ii), we obtain a contradiction with (i). So assume (iii). By (**Ind**), the intersection of $Choice^m_\beta(h_4)$ and $Choice^m_\alpha(h)$ is non-empty. Hence, by (1), [β *dstit*: C] is true at (m, h_4). But then C is true at (m, h_4), a contradiction with (iii).

If in addition to single doxastic subjects, also groups of such acting subjects are taken into account, the following expressions may be considered:

[E] α sees to it that Δ implicitly believes that A
[F] Δ sees to it that α implicitly believes that A
[G] Δ sees to it that Δ implicitly believes that A
[H] Δ sees to it that Γ implicitly believes that A

Of this list, item [E] does not prove to be highly interesting, since implicit, logically omniscient group belief is normally understood as implicit belief of all group members: [α *dstit*: $B_\Delta A$] if and only if for every $x \in \Delta$, [α *dstit*: $B_x A$]. Moreover, items [F], [G], and [H] immediately receive a formal semantics, because not only the interpretation of implicit group belief is clear but also because there is a formal semantics for [Δ *dstit*: A]. Item [G] is suggested to be read as "Δ forms the implicit belief that A". If $\Gamma \subseteq Agent$ and h is a history passing through $m \in T$, the set $Choice^m_\Gamma(h)$ of histories choice-equivalent with h for Γ at moment m is defined as $\{h' \mid (\forall \alpha \in \Gamma)\, h' \in Choice^m_\alpha(h)\}$.

DEFINITION 3. [Γ *dstit*: $B_\beta A$] is true in $\langle T, \leq, Agent, Choice, R, v\rangle$ at (m, h) iff (i) $\forall h' \in Choice^m_\Gamma(h)$, $\forall h'' \in H_m$, if $(m, h')R^m_\beta(m, h'')$ then A is true at (m, h''), and (ii) $\exists h', h'' \in H_m$ such that $(m, h')R^m_\beta(m, h'')$ and A is not true at (m, h'').

If we think of collective agents as acting independently of each other, it is reasonable to identify a single agent α with the singleton $\{\alpha\}$ and to assume the following generalization of **Ind**:

[2] An analogous observation holds true for the *achievement stit* operator, see [4], [2].

Ind′ For every moment m and every function f_m on $\mathcal{P}(Agent) \setminus \emptyset$ such that $f_m(\Delta) \in Choice^m_\Delta$ for all $\Delta \in \mathcal{P}(Agent) \setminus \emptyset$, $\bigcap \{f_m(\Delta) \mid \Delta \in \mathcal{P}(Agent) \setminus \emptyset\} \neq \emptyset$.

This means that the following formulas will never be evaluated as true (if $\Delta \neq \{\alpha\}$ and $\Delta \neq \Gamma$):

[I] $[\alpha\ \mathit{dstit}\colon [\Delta\ \mathit{dstit}\colon B_\Delta A]]$
[J] $[\Delta\ \mathit{dstit}\colon [\alpha\ \mathit{dstit}\ B_\alpha A]]$
[K] $[\Delta\ \mathit{dstit}\colon [\Gamma\ \mathit{dstit}\colon B_\Gamma A]]$

We can now observe that not only closure under logical consequence fails, but also closure under group membership.

Observation 2. *Under the present analysis, the inducement of implicit group belief and the formation (self-inducement) of implicit group belief is neither closed under logical consequence nor closed under group membership.*

In the sequel we shall use $[\alpha\ \mathit{vab}\colon A]$ ("α forms the implicit belief that A") respectively $[\Gamma\ \mathit{vab}: A]$ ("Γ forms the implicit belief that A") as an abbreviation for $[\alpha\ \mathit{dstit}\colon B_\alpha A]$ respectively $[\Gamma\ \mathit{dstit}\colon B_\Gamma A]$, where "*vab*" stands for "voluntarily acquires the implicit belief that".

4. Ascriptions of explicit belief

Since behavioral voluntarism appears to be wrong, also ascriptions of explicit belief ought to be non-agentive. The idea is that an individual agent α (or collective agent Δ) explicitly believes that A at moment/history pair (m, h) iff (i) there exists a moment m' earlier than (or equal to) m such that at (m', h), α (Δ) forms the implicit belief that A and (ii) since then α (Δ) has not given up the implicit belief that A. The notion of explicit belief to be modeled will exhibit the following wanted properties:

- if an agent explicitly believes that A, the agent implicitly believes that A;
- explicit beliefs require the formation of implicit beliefs.

The latter property reveals one important respect in which implicit and explicit beliefs differ. Implicit beliefs have been voluntarily acquired and not yet been abandoned only if they are also explicit beliefs. Note that according to the present proposal, since an agent cannot voluntarily acquire the implicit belief that A, if A is valid, and since the explicit belief that A requires the formation of the implicit belief that A, a valid formula cannot be explicitly believed. This feature is counterintuitive under the conception of explicit belief as implicit belief plus awareness, but it is natural according to the present understanding of explicit belief.

The expressions I intend to formalize are:

[L] α explicitly believes that A
[M] α sees to it that γ explicitly believes that A

The crucial point is the truth definition for [L]. The following definition provides clauses for ascriptions of explicit single-agent and group belief.

DEFINITION 4. $Bel_\alpha A$ ("agent α explicitly believes that A") is true in a doxastic dstit model $\langle T, \leq, Agent, Choice, R, v\rangle$ at moment/history pair (m, h) iff (i) $\exists m' \in T$ such that $m' \leq m$ and $[\alpha\ vab\colon A]$ is true at (m', h) and (ii) $\neg\exists m'' \in T$ such that $m' \leq m'' \leq m$ and $B_\alpha A$ is false at (m'', h).

$Bel_\Gamma A$ ("group Γ explicitly believes that A") is true in a doxastic dstit model $\langle T, \leq, \text{Agent}, \text{Choice}, R, v\rangle$ at moment/history pair (m, h) iff (i) $\exists m' \in T$ such that $m' \leq m$ and $[\Gamma\ vab\colon A]$ is true at (m', h) and (ii) $\neg\exists m'' \in T$ such that $m' \leq m'' \leq m$ and $B_\Gamma A$ is false at (m'', h).

Given this definition, we obtain the following reading for [M]:

[M] $[\alpha\ dstit\colon Bel_\gamma A]$

Group belief and group agency versions of [L] and [M] like $[\Delta\ dstit\colon Bel_\Gamma A]$ are straightforward.[3]

[3] In [17] I suggested introducing for every doxastic subject $\alpha \in Agent$ and every formula A a propositional constant $E_{\alpha,A}$ to be understood intuitively as "α is mistaken with respect to A". Moreover, $[\alpha\ vab{:}A]$ ("α voluntarily acquires the belief that A") was defined by stipulating that $[\alpha\ vab{:}A]$ is true in a dstit model $\langle T, \leq, Agent, Choice, v\rangle$ at moment/history pair (m, h) iff (i) $\forall h' \in Choice^m_\alpha(h)$, $((\neg A \supset E_{\alpha,A}) \wedge (A \supset \neg E_{\alpha,A}))$ is true at (m, h') and (ii) $\exists h'$ such that $m \in h'$ and $((\neg A \supset E_{\alpha,A}) \wedge (A \supset \neg E_{\alpha,A}))$ fails to be true at (m, h'). Further, it was proposed that $[\alpha\ gub\colon A]$ ("α voluntarily gives up the belief that A") is true in a dstit model $\langle T, \leq, Agent, Choice, v\rangle$ at moment/history pair (m, h) iff $[\alpha\ dstit\colon \neg((\neg A \supset E_{\alpha,A}) \wedge (A \supset \neg E_{\alpha,A}))]$ is true at (m, h). And finally, the truth definition for belief ascriptions took the following form: $[\alpha\ bel\colon A]$ ("α believes that A") is true in a dstit model $\langle T, \leq, Agent, Choice, v\rangle$ at moment/history pair (m, h) iff $\exists m' \in T$ such that $m' \leq m$ and $[\alpha\ vab\colon A]$ is true at (m', h) and, moreover, $\neg\exists m'' \in T$ such that $m' \leq m'' \leq m$ and $[\alpha\ gub\colon A]$ is true at (m'', h). Note that no distinction was drawn between implicit and explicit belief, and belief (simpliciter) was meant to be explicit, non-omniscient belief. Moreover, it was explicitly disclaimed that $((\neg A \supset E_{\alpha A}) \wedge (A \supset \neg E_{\alpha A}))$ is an adequate representation of "α believes that A". One problem with the above definition is that the object language notion of belief abandonment does not carry the presupposition

Observation 3. *Under the present analysis, explicit belief, inducement of explicit belief, and the formation (self-inducement) of explicit belief fails to be closed under logical consequence. Moreover, explicit group belief, inducement of explicit group belief, and the formation (self-inducement) of explicit group belief fails to be closed under group membership.*

Note that the present framework allows one to formally draw a number of interesting distinctions, for example a distinction between α forming an explicit disbelief, α seeing to it that α does not explicitly believe, α refraining from forming an explicit belief, and α refraining from forming an explicit disbelief:

$[\alpha\ dstit\colon Bel_\alpha \neg A]$
$[\alpha\ dstit\colon \neg Bel_\alpha A]$
$[\alpha\ dstit\colon \neg[\alpha\ dstit\colon Bel_\alpha A]]$
$[\alpha\ dstit\colon \neg[\alpha\ dstit\colon Bel_\alpha \neg A]]$

5. Conclusion

Anti-voluntarists often hold that the evidence or even the world directly causes our beliefs. Pojman [13] in his 'Phenomenological Argument Against Volitionalism' assumes that "[a]cquiring a belief is a happening in which the world forces itself upon a subject", and Audi [1] explains that "[m]y forming a belief is more like a glass of ice water's forming a damp ring on the table than like my forming a committee". Indeed, as a rule, if we perceive a tree before us, we form the belief that there is a tree. But even if it is ignored that talking about the perception of a tree is theory-loaded and that the interpretation of information as 'evidence' appears to be under voluntary control, it can hardly be ignored that beliefs can be false. Being aware of this fact, we may decide to believe against or according to the evidence. There is certainly much more to be said about directly controlling our beliefs and about habitually forming beliefs like believing that there is a tree if we perceive a tree before us. However, if the dstit semantics provides an adequate model of agency, the semantic clauses presented in the present paper show that ascriptions of belief formation, understood as ascriptions of decisions to believe, can be consistently interpreted.

the notion of belief abandonment has in natural language. In particular, $\neg[\alpha\ gub\colon A]$ does not imply $[\alpha\ bel\colon A]$. The same problem arises, if $[\alpha\ dstit\colon \neg B_\alpha A]$ is read as "α voluntarily gives up the implicit belief that A". The present, relational proposal appears to be more flexible than the earlier syntactic one, and, moreover, it ties up with Hintikka-style doxastic logic. Note also that the statement of condition **Ind** in [17] is erroneous.

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