A Minimal Model of \textit{viruddhāvyabhicārin}

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[0] Introduction

As is well known, a \textit{viruddhāvyabhicārin} or antinomy can be caused by two inferences each of which satisfies the three conditions of logical reason (\textit{liṅga, hetu}). The following inferences A and B which are given by Dignāga give rise to an antinomy, while each inference by itself is valid by the criteria of the three conditions stipulated in his \textit{Pramāṇasamuccaya}.

(A) Sound (\textit{sābda}) is non-eternal (\textit{aniyā}),
   because of being produced (\textit{kṛtakatvā}), like a pot (\textit{ghaṭa}).
(B) Sound is eternal (\textit{nityā}),
   because of being audible (\textit{śrāvaṇatvā}), like sound-ness (\textit{sabdatva}).

Because both inferences A and B are valid according to the three conditions (1. \textit{hetu} exists in the \textit{pakṣa}, 2. \textit{hetu} exists in only \textit{sapakṣa}, 3. \textit{hetu} does not exist in \textit{vipakṣa}), it is impossible to determine whether a sound is non-eternal or eternal\textsuperscript{1).} Here, however, the example (\textit{dṛṣṭānta}) “sound-ness” in the inference B is not accepted by Buddhists but by Nyāya-Vaiśeṣika schools (cf. Kitagawa, p.194). Dignāga states as follows:

For one who accepts eternal universals, both being-produced-ness and being-audible-ness make inconclusive reasons about whether a sound is eternal or non-eternal\textsuperscript{2).}

Then, is it necessary that although the inference A is considered valid by both Buddhists and their opponents, the validity of the inference B, namely the antinomy, is approved only by those who accept the “eternal universals”?\textsuperscript{3) In fact, Kitagawa (p.36, fn.49) says that the antinomy “can arise only when there is something wrong in the outlook on the universe,” and concludes that the metaphysical standpoint—there exists a universal, and it is perceived by a sense organ—, which is supposedly required to establish the eternality of sound, is wrong.
However, we can make a mathematical example of \textit{viruddhāvyabhicārin} \footnote{A necessary condition of \textit{viruddhāvyabhicārin}}. This fact leads us to the conclusion that the phenomenon of \textit{viruddhāvyabhicārin} has its logical root in the Dignāga’s logic of the three conditions of \textit{hetu} \footnote{The present paper shows a necessary condition of \textit{viruddhāvyabhicārin} and presents a minimal model of \textit{viruddhāvyabhicārin}. The model will gives us a clear view of the logical structure of \textit{viruddhāvyabhicārin}.}. The present paper shows a necessary condition of \textit{viruddhāvyabhicārin} and presents a minimal model of \textit{viruddhāvyabhicārin}. The model will gives us a clear view of the logical structure of \textit{viruddhāvyabhicārin}.

Let us suppose that the following pair of two valid inferences results in a \textit{viruddhāvyabhicārin}.

(A1) There exists S in p, because of H.

(A2) There exists T in p, because of G.

Here the properties H and G satisfy the three conditions of \textit{hetu} in the inference A1 and A2 respectively, and the properties S and T are incompatible (\textit{virodha}), that is to say, S and T cannot exist in p at the same time. Then we can prove that the \textit{pakṣa} p is the only locus (\textit{dharmin}) that has both H and G. Before going into the proof, some remarks are to be made.

In Dignāga’s \textit{Pramāṇasamuccaya} whether the basis of inference is the second condition of \textit{hetu}, the third condition, or the \textit{hetu-sādhyā} relationship (\textit{yatra} ... \textit{tatra} ...) is not so clear. J.F. Staal (1962 = 1988) took the \textit{hetu-sādhyā} relationship, which he terms \textit{vyāpti}, as the basis of inference and formalized it as (x)(A(h, x) \rightarrow A(s,x)), which reads: for any locus x if h exists in x then s exists in x. Although Staal dealt with Dharmakīrti’s logic, we can safely apply his formalizations in essence to Dignāga’s logic. In the following, I use the Chinese-Japanese Buddhist traditional term “example-body (喻体)” instead of “\textit{vyāpti}” since Dignāga’s meaning of “\textit{vyāpti}” is, it seems to me, ambiguous.

Staal proved successfully that the third condition of \textit{hetu} logically implies the example-body (\textit{yatra} ... \textit{tatra} ...), but failed in the proof of the implication of the example-body by the second condition of \textit{hetu}. The present paper will show the implication later. For the present, we also take the example-body as the basis of inference\footnote{Since S and T are incompatible, formulas (1) (x)(A(S, x) \rightarrow \sim A(T, x)) and}, and try to obtain a necessary condition of \textit{viruddhāvyabhicārin}.

A necessary condition of \textit{viruddhāvyabhicārin} is that the \textit{pakṣa} p is the only locus (\textit{dharmin}) that has both H and G. The proof is as follows.

Since S and T are incompatible, formulas

\[(1) (x)(A(S, x) \rightarrow \sim A(T, x))\]
A Minimal Model of *viruddhāvabhicārīn* (N. Ueda)

(2) \((x)(A(T, x) \rightarrow \sim A(S, x))\)

hold. Here \(A(S, x)\) means that the property \((dharma)\) \(S\) exists in the locus \((dharmin)\) \(x\). The symbol "\(\sim\)" denotes the propositional negation, and \((x)\) the universal quantifier. Then the formula (1) reads: for any locus \(x\) if \(S\) exists in \(x\) then \(T\) does not exist in the locus \(x\), and (2) reads: for any locus \(x\) if \(T\) exists in \(x\) then \(S\) does not exist in the locus \(x\).

Next, we formulate the example-bodies of \(A1\) and \(A2\) as (3) and (4) respectively:

(3) \((x) [(x \neq p) \wedge (A(H, x) \wedge A(S, x))]\)

(4) \((x) [(x \neq p) \wedge (A(G, x) \wedge A(T, x))]\).

The formula (3) reads: for any locus \(x\) if \(x\) has the property \(H\) then the locus \(x\) has the property \(S\) on the condition that the locus \(x\) is not the *pakṣa*. Read the formula (4) in the same manner.

From (1), (2), (3), and (4) we obtain a necessary condition of *viruddhāvabhicārīn*:

*pakṣa* \(p\) is the only locus \((dharmin)\) that has both \(H\) and \(G\).

<Proof> Suppose that there are some loci that have both properties \(H\) and \(G\) besides the *pakṣa* \(p\). That is to say, suppose that the following proposition holds:

\[\exists x((x \neq p) \wedge A(H, x) \wedge A(G, x)), \quad (\wedge \text{denotes a conjunction})\]

and name one of such loci "\(a\)". Then the following formula holds:

(5) \((a \neq p) \wedge A(H, a) \wedge A(G, a)\).

It is easy to see that (3) and (5) yield \(A(S, a)\), and (4) and (5) yield \(A(T, a)\), hence \(A(S,a) \wedge A(T,a)\) holds. But the proposition \(A(S,a) \wedge A(T,a)\) and (1) or (2) contradict each other. Consequently it must be the *pakṣa* that has both \(H\) and \(G\). </e.d.>


Considering the necessary condition obtained in the section [1], we can make a minimal model of *viruddhāvabhicārīn*. The following table exhibits the model.

(102)  

<table>
<thead>
<tr>
<th>inference</th>
<th><em>pakṣa</em></th>
<th><em>sādhyā-dharma</em></th>
<th><em>hetu</em></th>
<th><em>sapakṣa</em></th>
<th><em>vipakṣa</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>(p)</td>
<td>(S)</td>
<td>(H)</td>
<td>HS</td>
<td>GT</td>
</tr>
<tr>
<td>M2</td>
<td>(p)</td>
<td>(T)</td>
<td>(G)</td>
<td>GT</td>
<td>HS</td>
</tr>
</tbody>
</table>

*pakṣa* \(p\) = \(HG...\) = a locus \((dharmin)\) that has \(H\), \(G\) and others.

HS = a locus that has \(H\) and \(S\) (but has neither \(G\) nor \(T\))

GT = a locus that has \(G\) and \(T\) (but has neither \(H\) nor \(S\))

\(S\) and \(T\) are incompatible properties \((dharmas)\).
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(M1) There exists S in p, because of H, like HS.
(M2) There exists T in p, because of G, like GT.

It is easy to see that both \textit{hetus} H in M1 and G in M2 satisfy the three conditions of \textit{hetu}.

The universe of discourse comprises three loci (\textit{dharmams}) \{HG..., HS, GT\}, where "HG..." is identical with the \textit{pakśa}.

We can extend the above minimal model to any size. The following table shows a model in which any pair of the references gives rise to a \textit{viruddhāvyabhicārin}.

(Table 2)

<table>
<thead>
<tr>
<th>inference</th>
<th>pakśa</th>
<th>sādhyā-dharma</th>
<th>hetu</th>
<th>sapakśa</th>
<th>vipakśa</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>p</td>
<td>S</td>
<td>H</td>
<td>HS</td>
<td>GT, KU, JV, ...</td>
</tr>
<tr>
<td>M2</td>
<td>p</td>
<td>T</td>
<td>G</td>
<td>GT</td>
<td>HS, KU, JV, ...</td>
</tr>
<tr>
<td>M3</td>
<td>p</td>
<td>U</td>
<td>K</td>
<td>KU</td>
<td>HS, GT, JV, ...</td>
</tr>
<tr>
<td>M4</td>
<td>p</td>
<td>V</td>
<td>J</td>
<td>JV</td>
<td>HS, GT, KU, ...</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

\textit{pakśa} p = HGKJ...

Universe of discourse = \{p, HS, GT, KU, JV, ...\}

The sādhyā-dharma S, T, U, V, etc. contradict each other, that is to say, they are incompatible.

It is easy to see that any pair of the inferences in the table 2 results in an antinomy (\textit{viruddhāvyabhicārin}). For example, M1 and M3 give rise to an antinomy while the logical reasons H and K meet the three conditions of \textit{hetu} in M1 and M3 respectively.

A minimal model represented by concrete terms is given as follows, Suppose that the following statement holds as to the baseball players, Nomura, Nagashima and Ou:

Nomura is a player-manager, Nagashima is a manager, and Ou is a player.

Given a universe of discourse \{Nomura, Nagashima, Ou\}—a real baseball game requires more than three members, of course—, let us make the inferences M1 and M2.

(M1) Nomura (p) is not able to stand in the batter's box (S), because of being a manager (H), like Nagashima (HS).

(M2) Nomura (p) is able to stand in the batter's box (T), because of being a player (G), like Ou (GT).
Since the table 3 is obtained by substitutions of concrete terms for the table 1, it is evident that the inferences M1 and M2 in the table 3 result in an antinomy (Nomura = p, not able to stand in the batter’s box = S, able to stand in the batter’s box = T, manager = H, player = G, Nagashima = HS, Ou = GT).

[3] Deduction of example-body from the second condition of hetu

In the previous section, we constructed a minimal model of viruddhāvyabhicārin on the basis of the necessary condition (of viruddhāvyabhicārin) derived from the example-bodies in the inferences. However, the phenomenon of viruddhāvyabhicārin arises from the pair of inferences each of which is valid according to the three conditions of hetu. Therefore, it is required to derive logically the example-body from the second and third conditions of hetu. The formal deduction of example-body (vyāpti) from the third condition of hetu was essentially made by J.F.Staal (1962, = 1988 pp.93-108, especially pp.93-97). Only a slight modification of Staal’s formalization suffices to derive the Dignāga’s example-body from the third condition of hetu. So, we leave it aside now.

The second condition of hetu (sapakṣa eva sattvam: [hetu] exists only in sapakṣa) was formalized by Staal as (y)(A(H, y) → (y = sapakṣa)). And he made use of a restricted-variable to denote sapakṣa, with the result of the following formalization of the second condition of hetu (Staal, 1988, p.94):

\[(y)(A(H, y) \rightarrow (y = a \times ((x\neq p) \land A(S, x)))].\]

(In general, the restricted-variable \(a \times f(x)\) is made use of to denote any of the values of \(x\) such that \(f(x)\). Staal used the restricted-variable to handle sapakṣa as a term in a proposition.) He intended to deduce the formula of the example-body (vyāpti)—(y) (A(H, y) \rightarrow A(S, y))—from the above formula. But his proof was defective (cf. Staal, 1988, Introduction, p.23; Ueda 2001, pp.98-99).

Now, we present a formal deduction of the example-body from the second condition of hetu. In the following, the next symbols are used,

\[A(S-, x) : \sim A(S, x), (S- \text{ denotes the absence of the property } S)\]
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\[ K(S, x): (x \neq p) \land A(S, x) \]
\[ K(H, x): (x \neq p) \land A(H, x) \]

S, H : variables to denote properties.
\[ \leftrightarrow : \text{biconditional, namely, logical equivalency.} \]

We formalize the second condition of \textit{hetu} as

\[ (x)(K(H, x) \to x = \text{\textit{sapakṣa}}), \text{namely}, \]
\[ (6) \ (x)(K(H, x) \to x = a \ zK(S, z)). \text{(This reads: for any locus }x\text{ if }H\text{ exists in }x\text{ and }x\text{ is not the }\text{pakṣa}, \text{then }x\text{ is }\text{\textit{sapakṣa}.)} \]

The formula to be derived is:

\[ (3) \ (x) [(x \neq p) \to (A(H, x) \to A(S, x))]. \text{(Cf. section [1])} \]

We introduce an axiom:

\[ (x) \ (x = a \ zK(S, z) \leftrightarrow x \neq a \ z \ (K(S-, z) \lor (z = p))). \]

Intuitively, this axiom means that \textit{\textit{sapakṣa}} is neither \textit{vipakṣa} nor the \textit{pakṣa}, and that a locus which is neither \textit{vipakṣa} nor the \textit{pakṣa} is \textit{sapakṣa}.

The deduction is as follows:

\[ (6) \ (x)(K(H, x) \to x = a \ zK(S, z)) \]
\[ \leftrightarrow (x)(K(H, z) \to x \neq a \ z \ (K(S-, z) \lor (z = p))) \text{ (above axiom)} \]
\[ \leftrightarrow (x)(\sim K(H, x) \lor x \neq a \ z \ (K(S-, z) \lor (z = p))) \text{ (equivalency: } f(x) \to g(x) \leftrightarrow \sim f(x) \lor g(x) \text{)} \]
\[ \leftrightarrow \sim (\exists x)(K(H, z) \land x = a \ z \ (K(S-, z) \lor (z = p))) \text{ (}\exists x) f(x) \leftrightarrow \sim (\exists x) \sim f(x), \text{and de Morgan's law).} \]

I think we can conclude that \((\exists x)(x = a \ zf(z) \land g(x))\) is equivalent with \((\exists x)(f(x) \land g(x))\) in general.\(^7\) (Intuitively, both formulas mean that there exist some loci that satisfy both \(f\) and \(g\).) Hence, we derive \(\sim (\exists z)(K(H, z) \land (K(S-, z) \lor (z = p)))\) from \(\sim (\exists x)(K(H, z) \land x = a \ z \ (K(S-, z) \lor (z = p)))\).

\[ \sim (\exists z)(K(H, z) \land (K(S-, z) \lor (z = p))) \]
\[ \leftrightarrow \sim (\exists z)[K(H, z) \land K(S-, z)] \lor [K(H, z) \land (z = p)] \text{ (distributive law)} \]
\[ \leftrightarrow \sim (\exists z)[K(H, z) \land K(S-, z)] \lor (\exists z) [K(H, z) \land (z = p)] \text{ (}\exists z)f(z) \lor g(z) \leftrightarrow (\exists z)g(z) \text{)} \]
\[ \rightarrow \sim (\exists z)((K(H, z) \land K(S-, z)) \land A(H, z) \land (z = p)], \text{and the truth value of this formula is evidently false} \]
\[ \leftrightarrow (z) (\sim K(H, z) \lor \sim K(S-, z)) \text{ (}\sim (\exists x)f(x) \leftrightarrow (x) \sim f(x), \text{and de Morgan's law)} \]

\[ \sim 1141 \sim \]
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(\Leftrightarrow (z) (K(H, z) \rightarrow \sim K(S-, z)) \ (\sim f(z) \lor g(z) \Leftrightarrow f(z) \rightarrow g(z))

Here \(K(S-, z)\) means \((z\neq p) \land A(S-, z)\), namely, \((z\neq p) \land \sim A(S, z)\), therefore, 
\(\sim K(S-, z) \Leftrightarrow (z = p) \lor \sim A(S, z) \Leftrightarrow (z = p) \lor A(S, z)\).

Hence,

\( (z) (K(H, z) \rightarrow \sim K(S-, z)) \Leftrightarrow (z) (K(H, z) \rightarrow (z = p) \lor A(S, z)) \).

Replacing \(K(H, z)\) with \((z\neq p) \land A(H, z)\) in the right side formula, we get the formula:

(7) \( (z) ((z\neq p) \land A(H, z) \rightarrow (z = p) \lor A(S, z)) \).

(7) \( \Leftrightarrow (z) ((z\neq p) \land A(H, z) \rightarrow (z\neq p) \lor A(S, z)) \quad ((z = p) \leftrightarrow \sim (z\neq p)) \)

\( \Leftrightarrow (z) ((z\neq p) \land A(H, z) \rightarrow (z\neq p) \rightarrow A(S, z)) \ (\sim f(x) \lor g(x) \Leftrightarrow f(x) \rightarrow g(x)) \)

\( \Leftrightarrow (z) ((z\neq p) \rightarrow (A(H, z) \rightarrow A(S, z))) \quad [(R \land P \rightarrow (R \rightarrow Q)) \Leftrightarrow [R \rightarrow (P \rightarrow Q)]. \)

Replacing the variable \(z\) with \(x\), we obtain the formula of the example-body :

(3) \((x\neq p) \rightarrow (A(H, x) \rightarrow A(S, x))\). (Cf. section [1])

Incidently, we can derive the formula (3) from the following formalization of the second condition of hetu.

(8) \((x)(x = a \ zK(H, z) \rightarrow x = a \ zK(S, z))\)

In the formula (8), \(a \ zK(H, z)\) is a restricted-variable to denote any of the loci which are hetu-similar-instances and are not the pakṣa. Chinese-Japanese Buddhist logicians termed a locus that has hetu “hetu-similar-instance(因同品)”. (A locus that has sādhyā-dharma was termed “sādhyā-similar-instance(宗同品)”, which is sapakṣa in fact. Cf. Murakami/Sakaino, p.147.) The deduction of (3) from (8) is stated in the note 9).

4] Concluding remarks

We have obtained a necessary condition of viruddhāvyabhicārin on the basis of the example-body (vyāpti), and made a minimal model of viruddhāvyabhicārin using the condition, And we have shown that the second condition of hetu logically implies the example-body (the implication by the third condition of hetu was already shown by Staal), therefore we can safely say that the above necessary condition applies to the Dignāga’s logic of the three conditions of hetu. In connection with our argument, note that we do not need the concept of class or set to interpret the second (and third) condition of hetu.

Bibliography. K = Kanakavarman’s version of PSV. PSV = Pramāṇasamuccaya-vṛtti =
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1) Cf. PSV, p.495 K.

2) *rtag pahi spyi khas blaṅs pa la mñan par bya ba ṇīd daṅ byas pa ṇīd sgra la ci rtag gam mi rtag ces the tshom gyi rgyu yin no*, PSV p.505 K.

3) According to 基’s『因明入正理論疏』, the inference A is conducted by the Vaiśeṣika-school against the Sound-produced-school (声論論), while the inference B is conducted by the latter against the former (cf. Taisho 44, 126b3-7). Incidentally, the inference B—the example “soundness” is replaced by “self-admitted soundness (自許声性)”—as is conducted by the Sound-produced-school against the Buddhists is considered to be of no effect (cf. ibid., 116a27).

4) We define a universe of discourse as a set which comprises (1) the *pakṣa* (natural number 60), (2) multiples of 20 which are not multiples of 3, and (3) multiples of 3 which have the property S and are not multiples of 5. Here, S means the property of being a number whose remainder is 1 when divided by 4. That is to say, the universe of discourse = {60} ∪ {20, 40, 80, 100, 140,...} ∪ {9, 21, 33, 57, 69, 81, 93, 117,...}. Then, it is easy to see that the following inferences C and D give rise to a *viruddhāvyabhicārin*. (Cf. Ueda 2001, p.82)

(C) 60 is a multiple of 4, because of being a multiple of 5, like 20.

*sapakṣa*: 20, 40, 80, 100, 140,... *vipakṣa*: 9, 21, 33, 57, 69, 81, 93, 117,...

(D) 60 has the property $S$, because of being a multiple of 3, like 9.

*sapakṣa*: 9, 21, 33, 57, 69, 81, 93, 117,... *vipakṣa*: 20, 40, 80, 100, 140,...

5) Kamalaśīla denies, following Dharmakīrti, that there occurs a *viruddhāvyabhicārin* when inferences are based on fact (vastu). And Dharmakīrti admits that there can be a *viruddhāvyabhicārin* when inferences are made for the super-sensible objects based on the tradition (āgama). Cf. Ueda 2001, p.79, n.57.

6) It seems to me that Dignāga and the Chinese-Japanese Buddhist logicians consider the example-body in the inference of three parts to be identical with the second condition of hetu (cf. PS, ch.3 觀喻似喻品, k.1 <cf. Kitagawa, p.239-241> “two conditions (the second and third conditions) are shown by *drṣṭānta*”; 基『因明入正理論疏』Taisho 44, 109c27『陳那已後．說因三相即謂二喻．二喻即因．俱顯宗故』; ibid, 110a4『喻体實是因』; 善珠『因明論書論抄』

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Taisho 68, 289c1 「軌師云，因後二相，即是二喻」.

7) In the following, the symbol \( a \) stands for \( a zf(z) \). \(( \exists x) (x = a \land g(x)) \leftrightarrow (\exists x) (x = a \land g( a )) \) (since \( x = a \), \( g(x) \leftrightarrow g( a ) \)). In \( x = a \), \( x \) and \( a \) are two names of the same object. Therefore \(( \exists x)(x = a \land g( a )) \) means \(( \exists x)( \exists a ) (x = a \land g( a )) \). And \(( \exists a ) (x = a \land g( a )) \leftrightarrow (f(x) \land g(x)) \) (cf. Rosser 1953, p.166, ㎡.1.7(a)), hence, \(( \exists x) ( \exists a ) (x = a \land g( a )) \leftrightarrow ( \exists x)(f(x) \land g(x)) \). (Rosser, Chapter 6 “The Restricted Predicate Calculus” deals with the restricted-variables under the notations other than those used by Staal.)

8) Although the meaning of the formula (8) is rather much different from the original meaning of the second condition of \textit{hetu}, the formula (8) is decisively different from the formula (3) in that (8) contains the notion of similarity (similar-instance) while (3) does not. We find an (8)-like interpretation of the second condition of \textit{hetu} in a Japanese monk’s work: 不離宗同。必有因同。故云定有性。所以爾者。因第二相。其体即是（善珠『因明論論畳抄』Taisho 68, 267a25-26). Here, 宗同 and 因同 mean 宗同品 and 因同品, respectively.

9) If the equivalency of \(( \exists x)(x = a zf(z) \land x = a zg(z)) \) with \(( \exists x)(f(x) \land g(x)) \) is shown in general, then the formula (3) can be derived in the same manner with the deduction of (3) from (6). To show the equivalency, we use two rules concerning restricted-variables (cf. Staal, p.94):( \( a F(x))G( a xf(x)) \leftrightarrow (x)(F(x) \rightarrow G(x))( \text{rule 1} ), ( \exists y)(y = a xF(x)) \leftrightarrow ( \exists x)F(x) \leftrightarrow ( \exists y)(y = a xF(x)) \leftrightarrow ( \exists x)F(x)( \text{rule 2} ). \) The deduction is as follows, \(( \exists x)(x = a zf(z) \land x = a zg(z)) \leftrightarrow ( \exists x) \sim (x = a zf(z) \rightarrow x \neq a zg(z)) \leftrightarrow \sim (x)(x = a zf(z) \rightarrow x \neq a zg(z)). \) We redefine \( x = a zf(z) \) and \( x = a zg(z) \) as P(x) and Q(x), respectively. Then, \( \sim (x)(P(x) \sim Q(x)) \leftrightarrow ( \exists x)(P(x) \rightarrow Q(x)) \leftrightarrow ( \exists x)(P(x) \rightarrow Q(x))( \text{rule 1} ) \leftrightarrow ( \exists x)(P(x))Q( a xP(x)) \leftrightarrow ( \exists x)(P(x))Q( a xP(x)) \leftrightarrow ( \exists x)(P(x) \rightarrow g(z))( \text{see * below} ). \) Since the last formula means that among loci which satisfy P there exist some loci that satisfy g, we may conclude that \(( \exists x)(P(x) \rightarrow g(z))( \text{see * below} ) \leftrightarrow ( \exists y)(x = a zf(z) \land g(x)) \). And, as is stated in the note 7, \(( \exists x)(x = a zf(z) \land g(x)) \leftrightarrow ( \exists x)(f(x) \land g(x)) \).

*( \( \exists x)(P(x) \land g(x)) \leftrightarrow ( \exists x)(P(x) \rightarrow g(x)) \leftrightarrow ( \exists x)(P(x) \sim g(x)) \leftrightarrow ( \exists x)(P(x) \sim g(x)) \leftrightarrow ( a xP(x)) \sim g( a xP(x))( \text{rule 1} )) \leftrightarrow ( \exists x)(x)(a xP(x))g( a xP(x)).

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