Abstract: We evaluate the rational man in abstract argumentation. It is not tautologous, hence refuting its bounded rationality in choice. This forms a non tautologous fragment of the universal logic $VŁ4$.

We assume the method and apparatus of Meth8/$VŁ4$ with $T$autology as the designated proof value, $F$ as contradiction, $N$ as truthity (non-contingency), and $C$ as falsity (contingency). The 16-valued truth table is row-major and horizontal, or repeating fragments of $128$-tables, sometimes with table counts, for more variables. (See ersatz-systems.com.)


Abstract Abstract argumentation has emerged as a method for non-monotonic reasoning that has gained tremendous traction in the symbolic artificial intelligence community. In the literature, the different approaches to abstract argumentation that were refined over the years are typically evaluated from a logics perspective; an analysis that is based on models of ideal, rational decision-making does not exist. In this paper, we close this gap by analyzing abstract argumentation from the perspective of the rational man paradigm in microeconomic theory. To assess under which conditions abstract argumentation-based choice functions can be considered economically rational, we define a new argumentation principle that ensures compliance with the rational man’s reference independence property, which stipulates that a rational agent’s preferences over two choice options should not be influenced by the absence or presence of additional options. … [W]e investigate how structural properties of argumentation frameworks impact the reference independence principle, and propose a restriction to argumentation expansions that allows all of the evaluated semantics to fulfill the requirements for economically rational argumentation-based choice. For this purpose, we define the rational man’s expansion as a normal and non-cyclic expansion. Finally, we put reference independence into the context of preference-based argumentation and show that for this argumentation variant, which explicitly model preferences, the rational man’s expansion cannot ensure reference independence.

3. Theoretical background This section introduces the foundations upon which this paper builds: the rational man paradigm in economic theory and abstract argumentation frameworks, in particular argumentation semantics and principles.

3.1 The rational economic man paradigm

Definition 3 (reference independence). Given a set of choice options $A$ and any two possible subsets of choice options $A_1 \subseteq A$ and $A_2 \subseteq A$, with $A_1 \subseteq A_2$ and the rational man’s choices $A^*_1 \subseteq A_1$ (based on the choice options $A_1$) and $A^*_2 \subseteq A_2$, if $A^*_2 \subseteq A_1$, then $A^*_2 = A^*_1$.
A proof of this property for the “chose one” variant of the model is provided by Rubinstein, page 11: (1998). Modeling bounded rationality. MIT press. arielrubinstein.tau.ac.il/br/br.pdf.

“Consider a decision maker whose behavior regarding choices from subsets of the set \( A \) is described by a function \( C \) whose domain is the set of all non-empty subsets of \( A \) and whose range is the set \( A \). The element \( C(A) \) is interpreted as the decision maker’s choice whenever he confronts the decision problem \( A \). For every \( A, C(A) \in A \). (Note that for simplicity, and in contrast to some of the literature, it is required here that \( C(A) \) is a single element in \( A \) and not a subset of \( A \)).

We now come to an important necessary and sufficient condition for a choice function to be induced by a decision maker who behaves like a rational man. It is said that the decision maker’s behavior function \( C \) satisfies the consistency condition (sometimes referred to as the “independence of irrelevant alternatives”) if for all \( A \subseteq A_2 \subseteq A \), if \( C(A_2) \in A_1 \) then \( C(A_1) = C(A_2) \). That is, if the element chosen from the large set \( A_2 \) is a member of the smaller set \( A_1 \), then the decision maker chooses this element from the smaller set as well. It is easy to see that \( C \) is consistent if and only if there exists a preference relation \( \succeq \) over \( A \) such that for all \( A \subseteq A \), \( C(A) \) is the \( \succeq \)-maximal element in \( A \).”

\(3.2.1.1\)

\textbf{Remark 3.2.1.1:} We choose the Rubenstein formula because it is simpler by one variable and clearer than the text rendition in Eq. 3.1.1.1.

\[
\text{LET } p, q, r, s: \ A, A_1, A_2, C.
\]

\[
#(\neg(p \prec \neg(r \prec q))) \Rightarrow (\neg(s \& r) \prec q) \Rightarrow ((s \& q) = (s \& r)) ;
\]

\[
\text{T T T T} \quad \text{T T T T} \quad \text{T T T T} \quad \text{C T T T} \quad \text{(3.2.1.2)}
\]

With Eq. 3.2.1.1 in mind, we now backtrack to the text rendition in 3.1.1.1 to map that:

\[
\text{LET } p, q, r, s, t: \ A, A_1, A_2, A^*_1, A^*_2.
\]

\[
(\#(\neg(p < q) \& (\neg(p < r) \& \neg(r < q))) \& (\neg(q < s) \& \neg(r < t))) \Rightarrow (\neg(q < t) \Rightarrow (t = s)) ;
\]

\[
\text{T T T T} \quad \text{T T T T} \quad \text{C T T T} \quad \text{T T T T} \quad \text{T T T T} \quad \text{C T T T} \quad \text{T T T T} \quad \text{T T T T} \quad \text{64}
\]

\[
(\text{T T T T} \quad \text{C T T T} \quad \text{T T T T} \quad \text{T T T T}) \times 64
\]

\[
\text{(3.1.1.2)}
\]

Should the universal quantifier be removed in 3.1.1.1 and 3.1.2.1, the weaker \( \sqsubset \) becomes \( \Phi \) in truth table results for 3.1.1.2 and 3.1.2.2.

Eqs. 3.1.1.2 and 3.1.2.2 are not tautologous, hence refuting the seminal equation of the “rational man” and its bounded rationality in choice.