The Observer in Two Interpretations

Modal 13 — Modal Logic of Measurement in Copenhagen and MWI, Explained in the Style of a Chess Journalist

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Preliminary Note: How to Read This File

This file explains **Modal 13**: the role of the observer in the two quantum-mechanical interpretations — Copenhagen (DeLillo) and Many-Worlds (Van Dormael). In Modal 9 it was shown: The two perspectives are not compatible, but simultaneously true. In Modal 13 this distinction is applied to the **observer**.

It is written in the **same style** as the previous files: move by move, with symbol explanation at every step, with plain language for every statement.

What is presupposed: The files on Modal 5–12 should have been read. In particular, the bimodal modal logic (Modal 9) and the superposition axioms ASP1–ASP5 are presupposed as known.

What this file achieves: It shows three things:

1. The observer plays a **constitutive** role in the DeLillo perspective (Copenhagen), a **non-constitutive** role in the Van Dormael perspective (MWI).
2. This distinction can be formalized in **two observer operators** B_D and B_V.
3. Both observer conceptions lead to the Trinity — for different reasons. The Trinity is **observer-conception-invariant**.

Part I — The Role of the Observer

1. The Starting Situation

The starting situation in plain language: In Modal 9 it was shown: DeLillo (Copenhagen) and Van Dormael (MWI) are **not compatible**, but **simultaneously true**. In Modal 13 this distinction is applied to the **observer**.

The question: What role does the observer play in the two perspectives?

2. The DeLillo Perspective (Copenhagen)

The DeLillo perspective in plain language: In the Copenhagen interpretation, the observer is **constitutive**:

```
Without observer no measurement.
Without measurement no collapse.
Without collapse no reality.
```

The metaphysical meaning: The observer **generates** reality. He is **necessary** for the collapse of the wave function. He is a **singular event**.

3. The Van Dormael Perspective (MWI)

The Van Dormael perspective in plain language: In the Many-Worlds interpretation, the observer is **non-constitutive**:

```
No distinguished observer.
All worlds exist independently of whether they are observed.
The observer is himself part of the branching.
```

The metaphysical meaning: The observer **does not generate** reality. He is **not** necessary for reality. He is **multiple** — every world has its own observer.

4. The Distinction in a Table

The distinction:

Aspect	DeLillo (Copenhagen)	Van Dormael (MWI)
Observer	constitutive	non-constitutive
Role	generates reality	is part of branching
Number	singular	multiple
Necessity	necessary	not necessary

Part II — Two Observer Operators

1. The New Symbols

The new symbols in formulas:

```
B_D p    "p holds under the DeLillo observer (constitutive)"
B_V p    "p holds under the Van Dormael observer (non-constitutive)"
```

Symbol explanation:

- `B_D`: observer operator for the DeLillo perspective.
- `B_V`: observer operator for the Van Dormael perspective.
- `p`: a statement.

In plain language:

- `B_D p` holds in w if the observer in w **constitutes** the statement p.

- `B_V p` holds in w if p holds **structurally** in w — independent of the observer.

2. The Semantics

The semantics in formulas:

```
B_D p @w  holds  iff  the observer in w constitutes p
B_V p @w  holds  iff  p holds structurally in w (independent of the observer)
```

Symbol explanation:

- `@w`: “holds in world w”.
- `iff`: “if and only if”.
- `constitutes`: “generates” (the observer generates p).
- `structurally`: “independent of the observer”.

In plain language:

- `B_D p` holds in w if the observer in w **generates** the statement p.
- `B_V p` holds in w if p holds **even without** an observer.

3. The Two Observer Conceptions

The two conceptions in plain language:

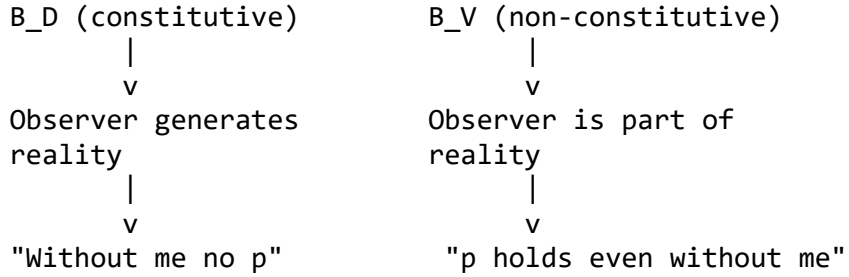
```
DeLillo observer (B_D):      The observer is constitutive.
                             Without him there is no reality.
                             He is a singular event.

Van Dormael observer (B_V):  The observer is non-constitutive.
                             He is himself part of the branching.
                             He is multiple.
```

Part III — The Axioms B1–B4

1. The Picture Behind the Axioms

Before I introduce the axioms, I give the **picture** behind them:



The picture in plain language: Imagine two painters. The **DeLillo painter** paints a picture — without him there would be no picture. The **Van Dormael painter** is himself part of the picture — the picture would exist even without him.

2. The Axioms B1–B4

The axioms in formulas:

```
B1   □(B_D p → p)
B2   □(B_V p → p)
B3   □(B_D p ↔ B_V p)
B4   □(B_D(U ∧ T ∧ S) ∧ B_V(U ∧ T ∧ S))
```

Symbol explanation:

- □: necessity.
- B_D, B_V: the two observer operators.
- →: implication.
- ↔: equivalence.
- ∧: conjunction.
- U, T, S: the three limits of the Trinity.

Now the four axioms individually — with picture and plain language:

B1 — Constitutivity implies reality

```
FORMULA     □(B_D p → p)
SYMBOLS     B_D = constitutive observer; → = implication
PICTURE     If the DeLillo painter paints a picture, then the picture
            exists. The constitutive observer generates reality.
PLAIN       "If the DeLillo observer constitutes p, then p holds."
```

B2 — Structure implies reality

```
FORMULA     □(B_V p → p)
SYMBOLS     B_V = non-constitutive observer
PICTURE     If the picture exists even without the Van Dormael painter,
            then it exists. Structural reality is independent of the
            observer.
PLAIN       "If p holds structurally, then p holds."
```

B3 — Observer relativity

```
FORMULA     □(B_D p ↔ B_V p)
SYMBOLS     ↔ = equivalence; B_D, B_V = the two observers
PICTURE     Although the two painters are different, they lead to the
            same statements. Reality is observer-conception-invariant.
PLAIN       "The two observer conceptions are equivalent – they lead
            to the same statements."
```

B4 — Trinity under both observers

```
FORMULA     □(B_D(U ∧ T ∧ S) ∧ B_V(U ∧ T ∧ S))
SYMBOLS     U, T, S = the three limits; ∧ = conjunction
PICTURE     The Trinity holds under both observer conceptions. It is
            not bound to a particular observer conception.
PLAIN       "The Trinity holds under both observer conceptions."
```

3. The Four Axioms in Context

The whole picture in one sentence:

```
The constitutive observer generates reality (B1).
The structural observer grasps reality (B2).
Both lead to the same statements (B3).
The Trinity holds under both (B4).
```

In plain language: The four axioms govern the relation of the two observer conceptions. They say: Both lead to reality, both are equivalent, and the Trinity holds under both.

Part IV — The Proof: Both Observer Conceptions Lead to the Trinity

1. The Theorem

The theorem in formulas:

`S5+SP+B1+B2+B3+B4 ⊢ □(U ∧ T ∧ S)`

Symbol explanation:

- `S5+SP+B1+B2+B3+B4`: the system of S5, superposition axioms, and the observer axioms.
- ⊢: "is derivable".
- □: necessity.
- `U`, `T`, `S`: the three limits.
- ∧: conjunction.

In plain language: In S5+SP+B1–B4 it is derivable: Necessarily, the Trinity holds.

2. The Proof Move by Move

Move 1 — From Modal 5: Trinity in S5+SP

```
BOARD       (empty — the proof begins)
MOVE        From Modal 5: Trinity in S5+SP
SYMBOLS     S5+SP ⊢ □(U ∧ T ∧ S)
WHY         In Modal 5 it was shown: In S5+SP the Trinity is derivable.
```

```
PLAIN       "In S5+SP the Trinity holds necessarily."
NEW         Line 1: □(U ∧ T ∧ S)
```

Move 2 — Apply B4

```
BOARD       Line 1: □(U ∧ T ∧ S)
MOVE        Apply B4
SYMBOLS     B4 := □(B_D(U ∧ T ∧ S) ∧ B_V(U ∧ T ∧ S))
WHY         B4 is available as an axiom. It says: The Trinity holds
            under both observer conceptions.
PLAIN       "The Trinity holds under both observer conceptions."
NEW         Line 2: B_D(U ∧ T ∧ S) ∧ B_V(U ∧ T ∧ S)
```

Move 3 — Apply B1

```
BOARD       Line 2: B_D(U ∧ T ∧ S) ∧ B_V(U ∧ T ∧ S)
MOVE        Apply B1 (to B_D(U ∧ T ∧ S))
SYMBOLS     B1 := □(B_D p → p)
            with p := (U ∧ T ∧ S)
WHY         B1 is available as an axiom. It says: What the constitutive
            observer constitutes holds.
PLAIN       "From B1: The Trinity holds under the DeLillo observer."
NEW         Line 3: B_D(U ∧ T ∧ S) → (U ∧ T ∧ S)
```

Move 4 — Apply B2

```
BOARD       Line 2: B_D(U ∧ T ∧ S) ∧ B_V(U ∧ T ∧ S)
MOVE        Apply B2 (to B_V(U ∧ T ∧ S))
SYMBOLS     B2 := □(B_V p → p)
            with p := (U ∧ T ∧ S)
WHY         B2 is available as an axiom. It says: What holds
            structurally holds.
PLAIN       "From B2: The Trinity also holds structurally."
NEW         Line 4: B_V(U ∧ T ∧ S) → (U ∧ T ∧ S)
```

Move 5 — Apply B3

```
BOARD       Line 2: B_D(U ∧ T ∧ S) ∧ B_V(U ∧ T ∧ S)
MOVE        Apply B3
SYMBOLS     B3 := □(B_D p ↔ B_V p)
            with p := (U ∧ T ∧ S)
WHY         B3 is available as an axiom. It says: The two observer
            conceptions are equivalent.
PLAIN       "From B3: The two observer conceptions lead to the same
            statements about the Trinity."
NEW         Line 5: B_D(U ∧ T ∧ S) ↔ B_V(U ∧ T ∧ S)
```

Move 6 — Summarize

```
BOARD       Line 3: B_D(U ∧ T ∧ S) → (U ∧ T ∧ S)
            Line 4: B_V(U ∧ T ∧ S) → (U ∧ T ∧ S)
            Line 5: B_D(U ∧ T ∧ S) ↔ B_V(U ∧ T ∧ S)
MOVE        Summarize
```

```
SYMBOLS     Both observer conceptions lead to the Trinity
WHY         From Line 3 and 4: Both observer conceptions lead to the
            Trinity. From Line 5: They are equivalent.
PLAIN       "Both observer conceptions lead to the Trinity — and they
            are equivalent."
NEW         Line 6: Both observer conceptions lead to U ∧ T ∧ S
```

Move 7 — Result

```
BOARD       Line 1: □(U ∧ T ∧ S)
            Line 6: Both observer conceptions lead to U ∧ T ∧ S
MOVE        Note necessity
SYMBOLS     □ = necessity
WHY         The Trinity holds in all worlds (Line 1). So it also holds
            under both observer conceptions.
PLAIN       "Necessarily the Trinity holds — under both observer
            conceptions."
NEW         □(U ∧ T ∧ S)
```

Final Result

```
FORMAL      S5+SP+B1+B2+B3+B4 ⊢ □(U ∧ T ∧ S)
PLAIN       "In S5+SP+B1–B4 the Trinity is derivable."
```

3. What the Proof Shows

What the proof shows:

- The Trinity follows **both** from the constitutive **and** from the structural observer conception.
- The two conceptions are **equivalent** (B3).
- The Trinity is **observer-conception-invariant**.

What the proof does not show:

- That the two conceptions are **identical**.
- That one of the two conceptions is **false**.
- That the choice of conception is **irrelevant**.

The point: Both conceptions lead to the same structure. The Trinity is **robust** with respect to the choice of observer conception.

Part V — Comparison with Everett, Bohr, Rovelli

1. Everett (MWI)

Everett in plain language: Everett (1957) formulated the Many-Worlds interpretation. In this interpretation:

```
The wave function does not collapse.
All possibilities are real.
The observer is himself part of the branching.
```

Comparison with our B_V: The Van Dormael observer corresponds to the Everettian observer. He is non-constitutive, but **structural**.

2. Bohr (Copenhagen)

Bohr in plain language: Bohr (1928) formulated the Copenhagen interpretation. In this interpretation:

```
The wave function collapses upon measurement.
The observer is constitutive for the measurement.
The classical world is necessary for the description.
```

Comparison with our B_D: The DeLillo observer corresponds to the Bohrian observer. He is constitutive for reality.

3. Rovelli (Relational QM)

Rovelli in plain language: Rovelli (1996) formulated relational quantum mechanics. In this interpretation:

```
States are relative to an observer.
There is no absolute state.
The observer is relationally defined.
```

Comparison with our B_D and B_V: Rovelli's observer is **neither** purely constitutive **nor** purely structural. He is **relational**. This is a **third** position that **neither** subsumes **nor** excludes our two operators.

4. The Point

The point in plain language: Our two operators B_D and B_V capture the two **classical** positions (Bohr and Everett). They do **not** capture the relational position (Rovelli). That is an open question (see Part VI).

Part VI — What Follows?

1. The Trinity Is Observer-Conception-Invariant

The central insight in plain language: The necessity of the Trinity is **not bound to a particular observer conception**. In S5+SP+B_D it is necessary for **constitutive** reasons. In S5+SP+B_V it is necessary for **structural** reasons. Both perspectives lead to the **same** structure.

Formally:

```
□(B_D(U ∧ T ∧ S) ∧ B_V(U ∧ T ∧ S))
```

2. The Consequences

Consequence 1: The Trinity is **observer-conception-invariant**. It follows from both conceptions.

Consequence 2: The choice of observer conception is **not** determined by the structure of reality. It is a **metaphysical** or **physical** question.

Consequence 3: The Trinity is **no artifact** of a particular observer conception. It is a **structural** property.

3. The Relation to Tradition

The relation to tradition in plain language: Classical metaphysics often seeks **one** foundation. The present treatise shows: There are **two** observer conceptions that **simultaneously** lead to the Trinity.

This is not a defect, but an insight: The Trinity is **robust** with respect to the choice of observer conception.

Part VII — What Remains Open

1. Is There an Observer-Independent Core?

The question: We have shown: Both observer conceptions lead to the Trinity. **Is there an observer-independent core** that underlies **both** conceptions?

Possible answers:

```
Answer 1: Yes. The observer-independent core is the structural unity
          of the Trinity. It holds independently of whether it is
          constituted by an observer or grasped structurally.

Answer 2: No. There is no observer-independent core. The Trinity is
          always observer-relative – either constitutive or
          structural.

Answer 3: The question is open. There are arguments for both positions.
```

What we have shown: We have **not** shown that there is an observer-independent core. We have only shown that **both** observer conceptions lead to the Trinity.

2. Is There a Third Observer Conception?

The question: Is there a **third** observer conception?

Possible candidates:

```
The relational conception (Rovelli).
The epistemic conception (QBism).
The process-philosophical conception (Whitehead).
```

3. Are B_D and B_V Equivalent or Different?

The question: Are the two observer operators B_D and B_V **equivalent** or **different**?

Answer: According to B3, they are equivalent. But B3 is itself an axiom. The question of whether B3 **necessarily** holds remains open.

Afterword

You have read this file. You have learned about the two observer operators B_D and B_V — with symbol explanation at every step and plain language for every statement. You have seen the axioms B1–B4. You have followed the proof of observer-conception invariance move by move. You have seen the comparison with Everett, Bohr, and Rovelli.

What remains is the insight:

```
The observer is not a foundation, but a perspective.
The Trinity is robust with respect to the choice of observer
conception.
It follows from both conceptions – for constitutive and for structural
reasons.
The Trinity is observer-conception-invariant.
```

The next file (Modal 14) treats **the unity of perspectives**: the formal version of the unity K(U, T, S) as constitutive structure, which follows from A1.

This file was written in the spirit of strict modal logic, yet in the language of a chess journalist — for the proof requires both: the precision of the formula and the vividness of the move.