Prof. Dr. Alfred Toth

Ränder und Grenzränder im vollständigen System semiotischer Dualsysteme

1. Wie schon sein Vorgänger (Toth 2013a), so dient auch der vorliegende Aufsatz als "Serviceartikel": Er stellt spezifisch Ränder und Grenzränder einander gegenüber, behandelt jedoch unter Benützung zweier neuerer Arbeiten (Toth 2013b, c) nicht nur die 10 regulären, sondern auch die 17 irregulären, d.h. alle über PZR = (.1., .2., .3.) (vgl. Bense 1981, S. 17 ff.) möglichen 27 semiotischen Dualsysteme.

2. Reguläre semiotische Dualsysteme

2.1. (3.1, 2.1, 1.1) × (1.1, 1.2, 1.3)

Ränder:

$\mathcal{R}_\lambda(3.1, 2.1, 1.1) = \emptyset$

$\mathcal{R}_\rho(3.1, 2.1, 1.1) = (3.2, 3.3, 2.2, 2.3, 1.2, 1.3)$

$\mathcal{R}_\lambda(1.1, 1.2, 1.3) = \emptyset$

$\mathcal{R}_\rho(1.1, 1.2, 1.3) = (2.1, 3.1, 2.2, 3.2, 2.3, 3.3)$

Grenzränder:

$G((3.1, 2.1, 1.1), (1.1, 1.2, 1.3)) \cap \mathcal{R}_\lambda(3.1, 2.1, 1.1) = \emptyset$

$G((3.1, 2.1, 1.1), (1.1, 1.2, 1.3)) \cap \mathcal{R}_\rho(3.1, 2.1, 1.1) = (1.2, 1.3)$

$G((3.1, 2.1, 1.1), (1.1, 1.2, 1.3)) \cap \mathcal{R}_\lambda(1.1, 1.2, 1.3) = \emptyset$

$G((3.1, 2.1, 1.1), (1.1, 1.2, 1.3)) \cap \mathcal{R}_\rho(1.1, 1.2, 1.3) = (2.1, 3.1).$

2.2. (3.1, 2.1, 1.2) × (2.1, 1.2, 1.3)

Ränder:

$\mathcal{R}_\lambda(3.1, 2.1, 1.2) = (1.1)$

$\mathcal{R}_\rho(3.1, 2.1, 1.2) = (3.2, 3.3, 2.2, 2.3, 1.3)$

$\mathcal{R}_\lambda(2.1, 1.2, 1.3) = (1.1)$

$\mathcal{R}_\rho(2.1, 1.2, 1.3) = (3.1, 2.2, 3.2,\ 2.3, 3.3)$

Grenzränder:

$G((3.1, 2.1, 1.2), (2.1, 1.2, 1.3)) \cap \mathcal{R}_\lambda(3.1, 2.1, 1.2) = \emptyset$

$G((3.1, 2.1, 1.2), (2.1, 1.2, 1.3)) \cap \mathcal{R}_\rho(3.1, 2.1, 1.2) = (1.3)$

$G((3.1, 2.1, 1.2), (2.1, 1.2, 1.3)) \cap \mathcal{R}_\lambda(2.1, 1.2, 1.3) = \emptyset$

$G((3.1, 2.1, 1.2), (2.1, 1.2, 1.3)) \cap \mathcal{R}_\rho(2.1, 1.2, 1.3) = (3.1).$

2.3. $(3.1, 2.1, 1.3) \times (3.1, 1.2, 1.3)$

Ränder:

$\mathcal{R}_\lambda(3.1, 2.1, 1.3) = (1.1, 1.2)$

$\mathcal{R}_\rho(3.1, 2.1, 1.3) = (3.2, 3.3, 2.2, 2.3)$

$\mathcal{R}_\lambda(3.1, 1.2, 1.3) = (1.1, 2.1)$

$\mathcal{R}_\rho(3.1, 1.2, 1.3) = (2.2, 3.2, 2.3, 3.3)$

Grenzränder:

$G((3.1, 2.1, 1.3), (3.1, 1.2, 1.3)) \cap \mathcal{R}_\lambda(3.1, 2.1, 1.3) = (1.2)$

$G((3.1, 2.1, 1.3), (3.1, 1.2, 1.3)) \cap \mathcal{R}_\rho(3.1, 2.1, 1.3) = \emptyset$

$G((3.1, 2.1, 1.3), (3.1, 1.2, 1.3)) \cap \mathcal{R}_\lambda(3.1, 1.2, 1.3) = (2.1)$

$G((3.1, 2.1, 1.3), (3.1, 1.2, 1.3)) \cap \mathcal{R}_\rho(3.1, 1.2, 1.3) = \emptyset.$

2.4. $(3.1, 2.2, 1.2) \times (2.1, 2.2, 1.3)$

Ränder:

$\mathcal{R}_\lambda(3.1, 2.2, 1.2) = (2.1, 1.1)$

$\mathcal{R}_\rho(3.1, 2.2, 1.2) = (3.2, 3.3, 2.3, 1.3)$

$\mathcal{R}_\lambda(2.1, 2.2, 1.3) = (1.1, 1.2)$

$\mathcal{R}_\rho(2.1, 2.2, 1.3) = (3.1, 3.2, 2.3, 3.3)$

Grenzränder:

$G((3.1, 2.2, 1.2), (2.1, 2.2, 1.3)) \cap \mathcal{R}_\lambda(3.1, 2.2, 1.2) = (2.1)$

$G((3.1, 2.2, 1.2), (2.1, 2.2, 1.3)) \cap \mathcal{R}_\rho(3.1, 2.2, 1.2) = (1.3)$

$G((3.1, 2.2, 1.2), (2.1, 2.2, 1.3)) \cap \mathcal{R}_\lambda(2.1, 2.2, 1.3) = (1.2)$

$G((3.1, 2.2, 1.2), (2.1, 2.2, 1.3)) \cap \mathcal{R}_\rho(2.1, 2.2, 1.3) = (3.1).$

2.5. $(3.1, 2.2, 1.3) \times (3.1, 2.2, 1.3)$

Ränder:

$\mathcal{R}_\lambda(3.1, 2.2, 1.3) = (2.1, 1.1, 1.2)$

$\mathcal{R}_\rho(3.1, 2.2, 1.3) = (3.2, 3.3, 2.3)$

$\mathcal{R}_\lambda(3.1, 2.2, 1.3) = (1.1, 2.1, 1.2)$

$\mathcal{R}_\rho(3.1, 2.2, 1.3) = (3.2, 2.3, 3.3)$

Grenzränder:

$G((3.1, 2.2, 1.3), (3.1, 2.2, 1.3)) \cap \mathcal{R}_\lambda(3.1, 2.2, 1.3) = \emptyset$

$G((3.1, 2.2, 1.3), (3.1, 2.2, 1.3)) \cap \mathcal{R}_\rho(3.1, 2.2, 1.3) = \emptyset$

$G((3.1, 2.2, 1.3), (3.1, 2.2, 1.3)) \cap \mathcal{R}_\lambda(3.1, 2.2, 1.3) = \emptyset$

$G((3.1, 2.2, 1.3), (3.1, 2.2, 1.3)) \cap \mathcal{R}_\rho(3.1, 2.2, 1.3) = \emptyset.$

2.6. $(3.1, 2.3, 1.3) \times (3.1, 3.2, 1.3)$

Ränder:

$\mathcal{R}_\lambda(3.1, 2.3, 1.3) = (2.1, 2.2, 1.1, 1.2)$

$\mathcal{R}_\rho(3.1, 2.3, 1.3) = (3.2, 3.3)$

$\mathcal{R}_\lambda(3.1, 3.2, 1.3) = (1.1, 2.1, 1.2, 2.2)$

$\mathcal{R}_\rho(3.1, 3.2, 1.3) = (2.3, 3.3)$

Grenzränder:

$G((3.1, 2.3, 1.3), (3.1, 3.2, 1.3)) \cap \mathcal{R}_\lambda(3.1, 2.3, 1.3) = \emptyset$

$G((3.1, 2.3, 1.3), (3.1, 3.2, 1.3)) \cap \mathcal{R}_\rho(3.1, 2.3, 1.3) = (3.2)$

$G((3.1, 2.3, 1.3), (3.1, 3.2, 1.3)) \cap \mathcal{R}_\lambda(3.1, 3.2, 1.3) = \emptyset$

$G((3.1, 2.3, 1.3), (3.1, 3.2, 1.3)) \cap \mathcal{R}_\rho(3.1, 3.2, 1.3) = (2.3)$.

2.7. $(3.2, 2.2, 1.2) \times (2.1, 2.2, 2.3)$

Ränder:

$\mathcal{R}_\lambda(3.2, 2.2, 1.2) = (3.1, 2.1, 1.1)$

$\mathcal{R}_\rho(3.2, 2.2, 1.2) = (3.3, 2.3, 1.3)$

$\mathcal{R}_\lambda(2.1, 2.2, 2.3) = (1.1, 1.2, 1.3)$

$\mathcal{R}_\rho(2.1, 2.2, 2.3) = (3.1, 3.2, 3.3)$

Grenzränder:

$G((3.2, 2.2, 1.2), (2.1, 2.2, 2.3)) \cap \mathcal{R}_\lambda(3.2, 2.2, 1.2) = (2.1)$

$G((3.2, 2.2, 1.2), (2.1, 2.2, 2.3)) \cap \mathcal{R}_\rho(3.2, 2.2, 1.2) = (2.3)$

$G((3.2, 2.2, 1.2), (2.1, 2.2, 2.3)) \cap \mathcal{R}_\lambda(2.1, 2.2, 2.3) = (1.2)$

$G((3.2, 2.2, 1.2), (2.1, 2.2, 2.3)) \cap \mathcal{R}_\rho(2.1, 2.2, 2.3) = (3.2)$.

2.8. $(3.2, 2.2, 1.3) \times (3.1, 2.2, 2.3)$

Ränder:

$\mathcal{R}_\lambda(3.2, 2.2, 1.3) = (3.1, 2.1, 1.1, 1.2)$

$\mathcal{R}_\rho(3.2, 2.2, 1.3) = (3.3, 2.3)$

$\mathcal{R}_\lambda(3.1, 2.2, 2.3) = (1.1, 2.1, 1.2, 1.3)$

$\mathcal{R}_\rho(3.1, 2.2, 2.3) = (3.2, 3.3)$

Grenzränder:

$G((3.2, 2.2, 1.3), (3.1, 2.2, 2.3)) \cap \mathcal{R}_\lambda(3.2, 2.2, 1.3) = (3.1)$

$G((3.2, 2.2, 1.3), (3.1, 2.2, 2.3)) \cap \mathcal{R}_\rho(3.2, 2.2, 1.3) = (2.3)$

$G((3.2, 2.2, 1.3), (3.1, 2.2, 2.3)) \cap \mathcal{R}_\lambda(3.1, 2.2, 2.3) = (1.3)$

$G((3.2, 2.2, 1.3), (3.1, 2.2, 2.3)) \cap \mathcal{R}_\rho(3.1, 2.2, 2.3) = (3.2)$.

2.9. $(3.2, 2.3, 1.3) \times (3.1, 3.2, 2.3)$

Ränder:

$\mathcal{R}_\lambda(3.2, 2.3, 1.3) = (3.1, 2.1, 2.2, 1.1, 1.2)$

$\mathcal{R}_\rho(3.2, 2.3, 1.3) = (3.3)$

$\mathcal{R}_\lambda(3.1, 3.2, 2.3) = (1.1, 2.1, 1.2, 2.2, 1.3)$

$\mathcal{R}_\rho(3.1, 3.2, 2.3) = (3.3)$

Grenzränder:

$G((3.2, 2.3, 1.3), (3.1, 3.2, 2.3)) \cap \mathcal{R}_\lambda(3.2, 2.3, 1.3) = (3.1)$

$G((3.2, 2.3, 1.3), (3.1, 3.2, 2.3)) \cap \mathcal{R}_\rho(3.2, 2.3, 1.3) = \emptyset$

$G((3.2, 2.3, 1.3), (3.1, 3.2, 2.3)) \cap \mathcal{R}_\lambda(3.1, 3.2, 2.3) = (1.3)$

$G((3.2, 2.3, 1.3), (3.1, 3.2, 2.3)) \cap \mathcal{R}_\rho(3.1, 3.2, 2.3) = \emptyset$.

2.10. $(3.3, 2.3, 1.3) \times (3.1, 3.2, 3.3)$

Ränder:

$\mathcal{R}_\lambda(3.3, 2.3, 1.3) = (3.1, 3.2, 2.1, 2.2, 1.1, 1.2)$

$\mathcal{R}_\rho(3.3, 2.3, 1.3) = \emptyset$

$\mathcal{R}_\lambda(3.1, 3.2, 3.3) = (1.1, 2.1, 1.2, 2.2, 1.3, 2.3)$

$\mathcal{R}_\rho(3.1, 3.2, 3.3) = \emptyset$

Grenzränder:

$G((3.3, 2.3, 1.3), (3.1, 3.2, 3.3)) \cap \mathcal{R}_\lambda(3.3, 2.3, 1.3) = (3.1, 3.2)$

$G((3.3, 2.3, 1.3), (3.1, 3.2, 3.3)) \cap \mathcal{R}_\rho(3.3, 2.3, 1.3) = \emptyset$

$G((3.3, 2.3, 1.3), (3.1, 3.2, 3.3)) \cap \mathcal{R}_\lambda(3.1, 3.2, 3.3) = (1.3, 2.3)$

$G((3.3, 2.3, 1.3), (3.1, 3.2, 3.3)) \cap \mathcal{R}_\rho(3.1, 3.2, 3.3) = \emptyset$.

3. Irreguläre semiotische Dualsysteme

3.1. $(3.1, 2.2, 1.1) \times (1.1, 2.2, 1.3)$

Ränder:

$\mathcal{R}_\lambda(3.1, 2.2, 1.1) = (2.1)$

$\mathcal{R}_\rho(3.1, 2.2, 1.1) = (3.2, 3.3, 2.3, 1.2, 1.3)$

$\mathcal{R}_\lambda(1.1, 2.2, 1.3) = (1.2)$

$\mathcal{R}_\rho(1.1, 2.2, 1.3) = (2.1, 3.1, 3.2, 2.3, 3.3)$

Grenzränder:

$G((3.1, 2.2, 1.1), (1.1, 2.2, 1.3)) \cap \mathcal{R}_\lambda(3.1, 2.2, 1.1) = \emptyset$

$G((3.1, 2.2, 1.1), (1.1, 2.2, 1.3)) \cap \mathcal{R}_\rho(3.1, 2.2, 1.1) = (1.3)$

$G((3.1, 2.2, 1.1), (1.1, 2.2, 1.3)) \cap \mathcal{R}_\lambda(1.1, 2.2, 1.3) = \emptyset$

$G((3.1, 2.2, 1.1), (1.1, 2.2, 1.3)) \cap \mathcal{R}_\rho(1.1, 2.2, 1.3) = (3.1)$.

3.2. $(3.1, 2.3, 1.1) \times (1.1, 3.2, 1.3)$

Ränder:

$\mathcal{R}_\lambda(3.1, 2.3, 1.1) = (2.1, 2.2)$

$\mathcal{R}_\rho(3.1, 2.3, 1.1) = (3.2, 3.3, 1.2, 1.3)$

$\mathcal{R}_\lambda(1.1, 3.2, 1.3) = (1.2, 2.2)$

$\mathcal{R}_\rho(1.1, 3.2, 1.3) = (2.1, 3.1, 2.3, 3.3)$

Grenzränder:

$G((3.1, 2.3, 1.1), (1.1, 3.2, 1.3)) \cap \mathcal{R}_\lambda(3.1, 2.3, 1.1) = \emptyset$

$G((3.1, 2.3, 1.1), (1.1, 3.2, 1.3)) \cap \mathcal{R}_\rho(3.1, 2.3, 1.1) = (1.3, 3.2)$

$G((3.1, 2.3, 1.1), (1.1, 3.2, 1.3)) \cap \mathcal{R}_\lambda(1.1, 3.2, 1.3) = \emptyset$

$G((3.1, 2.3, 1.1), (1.1, 3.2, 1.3)) \cap \mathcal{R}_\rho(1.1, 3.2, 1.3) = (2.3, 3.1).$

3.3. $(3.1, 2.3, 1.2) \times (2.1, 3.2, 1.3)$

Ränder:

$\mathcal{R}_\lambda(3.1, 2.3, 1.2) = (2.1, 2.2, 1.1)$

$\mathcal{R}_\rho(3.1, 2.3, 1.2) = (3.2, 3.3, 1.3)$

$\mathcal{R}_\lambda(2.1, 3.2, 1.3) = (1.1, 1.2, 2.2)$

$\mathcal{R}_\rho(2.1, 3.2, 1.3) = (3.1, 2.3, 3.3)$

Grenzränder:

$G((3.1, 2.3, 1.2), (2.1, 3.2, 1.3)) \cap \mathcal{R}_\lambda(3.1, 2.3, 1.2) = (2.1)$

$G((3.1, 2.3, 1.2), (2.1, 3.2, 1.3)) \cap \mathcal{R}_\rho(3.1, 2.3, 1.2) = (1.3, 3.2)$

$G((3.1, 2.3, 1.2), (2.1, 3.2, 1.3)) \cap \mathcal{R}_\lambda(2.1, 3.2, 1.3) = (1.2)$

$G((3.1, 2.3, 1.2), (2.1, 3.2, 1.3)) \cap \mathcal{R}_\rho(2.1, 3.2, 1.3) = (2.3, 3.1).$

3.4. $(3.2, 2.1, 1.1) \times (1.1, 1.2, 2.3)$

Ränder:

$\mathcal{R}_\lambda(3.2, 2.1, 1.1) = (3.1)$

$\mathcal{R}_\rho(3.2, 2.1, 1.1) = (3.3, 2.2, 2.3, 1.2, 1.3)$

$\mathcal{R}_\lambda(1.1, 1.2, 2.3) = (1.3)$

$\mathcal{R}_\rho(1.1, 1.2, 2.3) = (2.1, 3.1, 2.2, 3.2, 3.3)$

Grenzränder:

$G((3.2, 2.1, 1.1), (1.1, 1.2, 2.3)) \cap \mathcal{R}_\lambda(3.2, 2.1, 1.1) = \emptyset$

$G((3.2, 2.1, 1.1), (1.1, 1.2, 2.3)) \cap \mathcal{R}_\rho(3.2, 2.1, 1.1) = (1.2, 2.3)$

$G((3.2, 2.1, 1.1), (1.1, 1.2, 2.3)) \cap \mathcal{R}_\lambda(1.1, 1.2, 2.3) = \emptyset$

$G((3.2, 2.1, 1.1), (1.1, 1.2, 2.3)) \cap \mathcal{R}_\rho(1.1, 1.2, 2.3) = (3.2, 2.1)$.

3.5. $(3.2, 2.1, 1.2) \times (2.1, 1.2, 2.3)$

Ränder:

$\mathcal{R}_\lambda(3.2, 2.1, 1.2) = (3.1, 1.1)$

$\mathcal{R}_\rho(3.2, 2.1, 1.2) = (3.3, 2.2, 2.3, 1.3)$

$\mathcal{R}_\lambda(2.1, 1.2, 2.3) = (1.1, 1.3)$

$\mathcal{R}_\rho(2.1, 1.2, 2.3) = (3.1, 2.2, 3.2, 3.3)$

Grenzränder

$G((3.2, 2.1, 1.2), (2.1, 1.2, 2.3)) \cap \mathcal{R}_\lambda(3.2, 2.1, 1.2) = \emptyset$

$G((3.2, 2.1, 1.2), (2.1, 1.2, 2.3)) \cap \mathcal{R}_\rho(3.2, 2.1, 1.2) = (2.3)$

$G((3.2, 2.1, 1.2), (2.1, 1.2, 2.3)) \cap \mathcal{R}_\lambda(2.1, 1.2, 2.3) = \emptyset$

$G((3.2, 2.1, 1.2), (2.1, 1.2, 2.3)) \cap \mathcal{R}_\rho(2.1, 1.2, 2.3) = (3.2)$.

3.6. $(3.2, 2.1, 1.3) \times (3.1, 1.2, 2.3)$

Ränder:

$\mathcal{R}_\lambda(3.2, 2.1, 1.3) = (3.1, 1.1, 1.2)$

$\mathcal{R}_\rho(3.2, 2.1, 1.3) = (3.3, 2.2, 2.3)$

$\mathcal{R}_\lambda(3.1, 1.2, 2.3) = (1.1, 2.1, 1.3)$

$\mathcal{R}_\rho(3.1, 1.2, 2.3) = (2.2, 3.2, 3.3)$

Grenzränder:

$G((3.2, 2.1, 1.3), (3.1, 1.2, 2.3)) \cap \mathcal{R}_\lambda(3.2, 2.1, 1.3) = (1.2, 3.1)$

$G((3.2, 2.1, 1.3), (3.1, 1.2, 2.3)) \cap \mathcal{R}_\rho(3.2, 2.1, 1.3) = (2.3)$

$G((3.2, 2.1, 1.3), (3.1, 1.2, 2.3)) \cap \mathcal{R}_\lambda(3.1, 1.2, 2.3) = (1.3, 2.1)$

$G((3.2, 2.1, 1.3), (3.1, 1.2, 2.3)) \cap \mathcal{R}_\rho(3.1, 1.2, 2.3) = (3.2)$.

3.7. $(3.2, 2.2, 1.1) \times (1.1, 2.2, 2.3)$

Ränder:

$\mathcal{R}_\lambda(3.2, 2.2, 1.1) = (3.1, 2.1)$

$\mathcal{R}_\rho(3.2, 2.2, 1.1) = (3.3, 2.3, 1.2, 1.3)$

$\mathcal{R}_\lambda(1.1, 2.2, 2.3) = (1.2, 1.3)$

$\mathcal{R}_\rho(1.1, 2.2, 2.3) = (2.1, 3.1, 3.2, 3.3)$

Grenzränder:

$G((3.2, 2.2, 1.1), (1.1, 2.2, 2.3)) \cap \mathcal{R}_\lambda(3.2, 2.2, 1.1) = \emptyset$

$G((3.2, 2.2, 1.1), (1.1, 2.2, 2.3)) \cap \mathcal{R}_\rho(3.2, 2.2, 1.1) = (2.3)$

$G((3.2, 2.2, 1.1), (1.1, 2.2, 2.3)) \cap \mathcal{R}_\lambda(1.1, 2.2, 2.3) = \emptyset$

$G((3.2, 2.2, 1.1), (1.1, 2.2, 2.3)) \cap \mathcal{R}_\rho(1.1, 2.2, 2.3) = (3.2)$.

3.8. $(3.2, 2.3, 1.1) \times (1.1, 3.2, 2.3)$

Ränder:

$\mathcal{R}_\lambda(3.2, 2.3, 1.1) = (3.1, 2.1, 2.2)$

$\mathcal{R}_\rho(3.2, 2.3, 1.1) = (3.3, 1.2, 1.3)$

$\mathcal{R}_\lambda(1.1, 3.2, 2.3) = (1.2, 2.2, 1.3)$

$\mathcal{R}_\rho(1.1, 3.2, 2.3) = (2.1, 3.1, 3.3)$

Grenzränder:

$G((3.2, 2.3, 1.1), (1.1, 3.2, 2.3)) \cap \mathcal{R}_\lambda(3.2, 2.3, 1.1) = \emptyset$

$G((3.2, 2.3, 1.1), (1.1, 3.2, 2.3)) \cap \mathcal{R}_\rho(3.2, 2.3, 1.1) = \emptyset$

$G((3.2, 2.3, 1.1), (1.1, 3.2, 2.3)) \cap \mathcal{R}_\lambda(1.1, 3.2, 2.3) = \emptyset$

$G((3.2, 2.3, 1.1), (1.1, 3.2, 2.3)) \cap \mathcal{R}_\rho(1.1, 3.2, 2.3) = \emptyset$.

3.9. $(3.2, 2.3, 1.2) \times (2.1, 3.2, 2.3)$

Ränder:

$\mathcal{R}_\lambda(3.2, 2.3, 1.2) = (3.1, 2.1, 2.2, 1.1)$

$\mathcal{R}_\rho(3.2, 2.3, 1.2) = (3.3, 1.3)$

$\mathcal{R}_\lambda(2.1, 3.2, 2.3) = (1.1, 1.2, 2.2, 1.3)$

$\mathcal{R}_\rho(2.1, 3.2, 2.3) = (3.1, 3.3)$

Grenzränder:

$G((3.2, 2.3, 1.2), (2.1, 3.2, 2.3)) \cap \mathcal{R}_\lambda(3.2, 2.3, 1.2) = (2.1)$

$G((3.2, 2.3, 1.2), (2.1, 3.2, 2.3)) \cap \mathcal{R}_\rho(3.2, 2.3, 1.2) = \emptyset$

$G((3.2, 2.3, 1.2), (2.1, 3.2, 2.3)) \cap \mathcal{R}_\lambda(2.1, 3.2, 2.3) = (1.2)$

$G((3.2, 2.3, 1.2), (2.1, 3.2, 2.3)) \cap \mathcal{R}_\rho(2.1, 3.2, 2.3) = \emptyset$.

3.10. $(3.3, 2.1, 1.1) \times (1.1, 1.2, 3.3)$

Ränder:

$\mathcal{R}_\lambda(3.3, 2.1, 1.1) = (3.1, 3.2)$

$\mathcal{R}_\rho(3.3, 2.1, 1.1) = (2.2, 2.3, 1.2, 1.3)$

$\mathcal{R}_\lambda(1.1, 1.2, 3.3) = (1.3, 2.3)$

$\mathcal{R}_\rho(1.1, 1.2, 3.3) = (2.1, 3.1, 2.2, 3.2)$

Grenzränder:

$G((3.3, 2.1, 1.1), (1.1, 1.2, 3.3)) \cap \mathcal{R}_\lambda(3.3, 2.1, 1.1) = \emptyset$

$G((3.3, 2.1, 1.1), (1.1, 1.2, 3.3)) \cap \mathcal{R}_\rho(3.3, 2.1, 1.1) = (1.2)$

$G((3.3, 2.1, 1.1), (1.1, 1.2, 3.3)) \cap \mathcal{R}_\lambda(1.1, 1.2, 3.3) = \emptyset$

$G((3.3, 2.1, 1.1), (1.1, 1.2, 3.3)) \cap \mathcal{R}_\rho(1.1, 1.2, 3.3) = (2.1)$.

3.11. $(3.3, 2.1, 1.2) \times (2.1, 1.2, 3.3)$

Ränder:

$\mathcal{R}_\lambda(3.3, 2.1, 1.2) = (3.1, 3.2, 1.1)$

$\mathcal{R}_\rho(3.3, 2.1, 1.2) = (2.2, 2.3, 1.3)$

$\mathcal{R}_\lambda(2.1, 1.2, 3.3) = (1.1, 1.3, 2.3)$

$\mathcal{R}_\rho(2.1, 1.2, 3.3) = (3.1, 2.2, 3.2)$

Grenzränder:

$G((3.3, 2.1, 1.2), (2.1, 1.2, 3.3)) \cap \mathcal{R}_\lambda(3.3, 2.1, 1.2) = \emptyset$

$G((3.3, 2.1, 1.2), (2.1, 1.2, 3.3)) \cap \mathcal{R}_\rho(3.3, 2.1, 1.2) = \emptyset$

$G((3.3, 2.1, 1.2), (2.1, 1.2, 3.3)) \cap \mathcal{R}_\lambda(2.1, 1.2, 3.3) = \emptyset$

$G((3.3, 2.1, 1.2), (2.1, 1.2, 3.3)) \cap \mathcal{R}_\rho(2.1, 1.2, 3.3) = \emptyset$.

3.12. $(3.3, 2.1, 1.3) \times (3.1, 1.2, 3.3)$

Ränder:

$\mathcal{R}_\lambda(3.3, 2.1, 1.3) = (3.1, 3.2, 1.1, 1.2)$

$\mathcal{R}_\rho(3.3, 2.1, 1.3) = (2.2, 2.3)$

$\mathcal{R}_\lambda(3.1, 1.2, 3.3) = (1.1, 2.1, 1.3, 2.3)$

$\mathcal{R}_\rho(3.1, 1.2, 3.3) = (2.2, 3.2)$

Grenzränder:

$G((3.3, 2.1, 1.3), (3.1, 1.2, 3.3) \cap \mathcal{R}_\lambda(3.3, 2.1, 1.3) = (1.2, 3.1)$

$G((3.3, 2.1, 1.3), (3.1, 1.2, 3.3)) \cap \mathcal{R}_\rho(3.3, 2.1, 1.3) = \emptyset$

$G((3.3, 2.1, 1.3), (3.1, 1.2, 3.3)) \cap \mathcal{R}_\lambda(3.1, 1.2, 3.3) = (1.3, 2.1)$

$G((3.3, 2.1, 1.3), (3.1, 1.2, 3.3)) \cap \mathcal{R}_\rho(3.1, 1.2, 3.3) = \emptyset$.

3.13. $(3.3, 2.2, 1.1) \times (1.1, 2.2, 3.3)$

Ränder:

$\mathcal{R}_\lambda(3.3, 2.2, 1.1) = (3.1, 3.2, 2.1)$

$\mathcal{R}_\rho(3.3, 2.2, 1.1) = (2.3, 1.2, 1.3)$

$\mathcal{R}_\lambda(1.1, 2.2, 3.3) = (1.2, 1.3, 2.3)$

$\mathcal{R}_\rho(1.1, 2.2, 3.3) = (2.1, 3.1, 3.2)$

Grenzränder:

$G((3.3, 2.2, 1.1), (1.1, 2.2, 3.3) \cap \mathcal{R}_\lambda(3.3, 2.2, 1.1) = \emptyset$

$G((3.3, 2.2, 1.1), (1.1, 2.2, 3.3)) \cap \mathcal{R}_\rho(3.3, 2.2, 1.1) = \emptyset$

$G((3.3, 2.2, 1.1), (1.1, 2.2, 3.3)) \cap \mathcal{R}_\lambda(1.1, 2.2, 3.3) = \emptyset$

$G((3.3, 2.2, 1.1), (1.1, 2.2, 3.3)) \cap \mathcal{R}_\rho(1.1, 2.2, 3.3) = \emptyset$.

3.14. $(3.3, 2.2, 1.2) \times (2.1, 2.2, 3.3)$

Ränder:

$\mathcal{R}_\lambda(3.3, 2.2, 1.2) = (3.1, 3.2, 2.1, 1.1)$

$\mathcal{R}_\rho(3.3, 2.2, 1.2) = (2.3, 1.3)$

$\mathcal{R}_\lambda(2.1, 2.2, 3.3) = (1.1, 1.2, 1.3, 2.3)$

$\mathcal{R}_\rho(2.1, 2.2, 3.3) = (3.1, 3.2)$

Grenzränder:

$G((3.3, 2.2, 1.2), (2.1, 2.2, 3.3) \cap \mathcal{R}_\lambda(3.3, 2.2, 1.2) = (2.1)$

$G((3.3, 2.2, 1.2), (2.1, 2.2, 3.3)) \cap \mathcal{R}_\rho(3.3, 2.2, 1.2) = \emptyset$

$G((3.3, 2.2, 1.2), (2.1, 2.2, 3.3)) \cap \mathcal{R}_\lambda(2.1, 2.2, 3.3) = (1.2)$

$G((3.3, 2.2, 1.2), (2.1, 2.2, 3.3)) \cap \mathcal{R}_\rho(2.1, 2.2, 3.3) = \emptyset.$

3.15. $(3.3, 2.2, 1.3) \times (3.1, 2.2, 3.3)$

Ränder:

$\mathcal{R}_\lambda(3.3, 2.2, 1.3) = (3.1, 3.2, 2.1, 1.1, 1.2)$

$\mathcal{R}_\rho(3.3, 2.2, 1.3) = (2.3)$

$\mathcal{R}_\lambda(3.1, 2.2, 3.3) = (1.1, 2.1, 1.2, 1.3, 2.3)$

$\mathcal{R}_\rho(3.1, 2.2, 3.3) = (3.2)$

Grenzränder:

$G((3.3, 2.2, 1.3), (3.1, 2.2, 3.3) \cap \mathcal{R}_\lambda(3.3, 2.2, 1.3) = (3.1)$

$G((3.3, 2.2, 1.3), (3.1, 2.2, 3.3)) \cap \mathcal{R}_\rho(3.3, 2.2, 1.3) = \emptyset$

$G((3.3, 2.2, 1.3), (3.1, 2.2, 3.3)) \cap \mathcal{R}_\lambda(3.1, 2.2, 3.3) = (1.3)$

$G((3.3, 2.2, 1.3), (3.1, 2.2, 3.3)) \cap \mathcal{R}_\rho(3.1, 2.2, 3.3) = \emptyset.$

3.16. $(3.3, 2.3, 1.1) \times (1.1, 3.2, 3.3)$

Ränder:

$\mathcal{R}_\lambda(3.3, 2.3, 1.1) = (3.1, 3.2, 2.1, 2.2)$

$\mathcal{R}_\rho(3.3, 2.3, 1.1) = (1.2, 1.3)$

$\mathcal{R}_\lambda(1.1, 3.2, 3.3) = (1.2, 2.2, 1.3, 2.3)$

$\mathcal{R}_\rho(1.1, 3.2, 3.3) = (2.1, 3.1)$

Grenzränder:

$G((3.3, 2.3, 1.1), (1.1, 3.2, 3.3) \cap \mathcal{R}_\lambda(3.3, 2.3, 1.1) = (3.2)$

$G((3.3, 2.3, 1.1), (1.1, 3.2, 3.3)) \cap \mathcal{R}_\rho(3.3, 2.3, 1.1) = \emptyset$

$G((3.3, 2.3, 1.1), (1.1, 3.2, 3.3)) \cap \mathcal{R}_\lambda(1.1, 3.2, 3.3) = (2.3)$

$G((3.3, 2.3, 1.1), (1.1, 3.2, 3.3)) \cap \mathcal{R}_\rho(1.1, 3.2, 3.3) = \emptyset.$

3.17. $(3.3, 2.3, 1.2) \times (2.1, 3.2, 3.3)$

Ränder:

$\mathcal{R}_\lambda(3.3, 2.3, 1.2) = (3.1, 3.2, 2.1, 2.2, 1.1)$

$\mathcal{R}_\rho(3.3, 2.3, 1.2) = (1.3)$

$\mathcal{R}_\lambda(2.1, 3.2, 3.3) = (1.1, 1.2, 2.2, 1.3, 2.3)$

$\mathcal{R}_\rho(2.1, 3.2, 3.3) = (3.1)$

Grenzränder:

$G((3.3, 2.3, 1.2), (2.1, 3.2, 3.3) \cap \mathcal{R}_\lambda(3.3, 2.3, 1.2) = (2.1, 3.2)$

$G((3.3, 2.3, 1.2), (2.1, 3.2, 3.3)) \cap \mathcal{R}_\rho(3.3, 2.3, 1.2) = \emptyset$

$G((3.3, 2.3, 1.2), (2.1, 3.2, 3.3)) \cap \mathcal{R}_\lambda(2.1, 3.2, 3.3) = (1.2, 2.3)$

$G((3.3, 2.3, 1.2), (2.1, 3.2, 3.3)) \cap \mathcal{R}_\rho(2.1, 3.2, 3.3) = \emptyset.$

Literatur

Toth, Alfred, Isomorphe und homomorphe semiotische Grenzen und Ränder. In: Electronic Journal for Mathematical Semiotics, 2013a

Toth, Alfred, Grenzen und Ränder von Zeichenklassen und ihren dualen Realitätsthematiken. In: Electronic Journal for Mathematical Semiotics, 2013b

Toth, Alfred, Ränder und Grenzen irregulärer semiotischer Dualsysteme. In: Electronic Journal for Mathematical Semiotics, 2013c