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**On the parallel between normality and extremal disconnectedness. (English summary)**

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In this article the authors examine the parallel between normality and extremal disconnectedness in the localic/pointfree context. They indicate that the two notions are dual to each other, and determine the source of this duality. In their approach, each pair of results (in this dual layout) is unified under one result with a single proof. Their results are conveniently categorized into four main areas:

- (1) Urysohn's separation type lemma,
- (2) Tietze's extension type theorem,
- (3) Katětov-Tong insertion type theorem,
- (4) Hausdorff mapping invariance type theorem.

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### References

1. R.N. Ball, J. Walters-Wayland,  $C$ - and  $C^*$ -quotients in pointfree topology, *Dissertationes Math. (Rozprawy Mat.)* 412 (2002), 62 pp. [MR1952051 \(2004a:06007\)](#)
2. B. Banaschewski,  $\sigma$ -frames, 1980, unpublished manuscript.
3. B. Banaschewski, *The Real Numbers in Pointfree Topology*, *Textos de Matemática*, vol. 12, University of Coimbra, 1997. [MR1621835 \(99c:54017\)](#)
4. B. Banaschewski, A new aspect of the cozero lattice in pointfree topology, *Topology Appl.* 156 (2009) 2028–2038. [MR2532132 \(2010j:54022\)](#)
5. B. Banaschewski, C. Gilmour, Pseudocompactness and the cozero part of a frame, *Comment. Math. Univ. Carolin.* 37 (1996) 577–587. [MR1426922 \(98f:54028\)](#)
6. B. Banaschewski, J. Gutiérrez García, J. Picado, Extended real functions in pointfree topology, *J. Pure Appl. Algebra* 216 (2012) 905–922. [MR2864864](#)
7. B. Banaschewski, A. Pultr, Variants of openness, *Appl. Categ. Structures* 2 (1994) 331–350. [MR1300720 \(95j:06012\)](#)
8. J. Blatter, G.L. Seever, Interposition of semicontinuous functions by continuous functions, in: *Analyse Fonctionnelle et Applications*, *Comptes Rendus d'Colloque d'Analyse*, Rio de Janeiro, 1972, Hermann, Paris, 1975, pp. 27–51. [MR0435793 \(55 #8749\)](#)
9. G. Buskes, A. van Rooij, *Topological Spaces: From Distance to Neighborhood*, Springer, New York, 1997. [MR1464692 \(98f:54001\)](#)
10. R.P. Dilworth, The normal completion of the lattice of continuous functions, *Trans. Amer. Math. Soc.* 68 (1950) 427–438. [MR0034822 \(11,647g\)](#)
11. M.J. Ferreira, J. Gutiérrez García, J. Picado, Completely normal frames and real-valued functions, *Topology Appl.* 156 (2009) 2932–2941. [MR2556049 \(2011c:54013\)](#)
12. L. Gillman, M. Jerison, *Rings of Continuous Functions*, Van Nostrand, 1960. [MR0116199 \(22 #6994\)](#)
13. J. Gutiérrez García, T. Kubiak, Sandwich-type characterizations of completely regular spaces, *Appl. Gen. Topol.* 8 (2007) 239–242. [MR2398514 \(2009c:54006\)](#)
14. J. Gutiérrez García, T. Kubiak, General insertion and extension theorems for localic real functions, *J. Pure Appl. Algebra* 215 (2011) 1198–1204. [MR2769226](#)

- (2012a:54013)
15. J. Gutiérrez García, T. Kubiak, J. Picado, Lower and upper regularizations of frame semicontinuous real functions, *Algebra Univers.* 60 (2009) 169–184 [MR2491421](#) (2010e:54015)
  16. J. Gutiérrez García, T. Kubiak, J. Picado, Pointfree forms of Dowker’s and Michael’s insertion theorems, *J. Pure Appl. Algebra* 213 (2009) 98–108. [MR2462988](#) (2010a:06019)
  17. J. Gutiérrez García, T. Kubiak, J. Picado, Localic real-valued functions: a general setting, *J. Pure Appl. Algebra* 213 (2009) 1064–1074. [MR2498797](#) (2010a:06020)
  18. J. Gutiérrez García, T. Kubiak, J. Picado, Perfectness in locales, in preparation.
  19. J. Gutiérrez García, T. Kubiak, M.A. de Prada Vicente, Insertion of lattice-valued and hedgehog-valued functions, *Topology Appl.* 153 (2006) 1458–147 [MR2211211](#) (2006m:54037)
  20. J. Gutiérrez García, J. Picado, On the algebraic representation of semicontinuity, *J. Pure Appl. Algebra* 210 (2007) 299–306. [MR2319999](#) (2008b:54025)
  21. J. Gutiérrez García, J. Picado, Rings of real functions in pointfree topology, *Topology Appl.* 158 (2011) 2264–2278. [MR2838376](#) (2012i:06020)
  22. J. Gutiérrez García, J. Picado, Insertion and extension results for point-free complete regularity, *Bull. Belg. Math. Soc. Simon Stevin* 20 (2013) 675–68 [MR3129067](#)
  23. F. Hausdorff, Gestufte Räume, *Fund. Math.* 25 (1935) 486–502.
  24. J. Isbell, First steps in descriptive theory of locales, *Trans. Amer. Math. Soc.* 327 (1991) 353–371. [MR1091230](#) (92b:54078)
  25. E.P. de Jager, H.-P.A. Künzi, Permutable pairs of quasi-uniformities, *Topology Appl.* 158 (2011) 930–938. [MR2783147](#) (2012g:54054)
  26. P.B. Johnson,  $k$ -Lindelöf locales and their spatial parts, *Cah. Topol. Géom. Différ. Catég.* 32 (1991) 297–313. [MR1165826](#) (93g:54036)
  27. P.T. Johnstone, *Stone Spaces*, Cambridge University Press, Cambridge, 1982. [MR0698074](#) (85f:54002)
  28. M. Katětov, On real valued functions in topological spaces, *Fund. Math.* 38 (1951) 85–91; *Fund. Math.* 40 (1953) 139–142 (Correction). [MR0050264](#) (14,304a)
  29. W. Kotzé, T. Kubiak, Insertion of a measurable function, *J. Austral. Math. Soc. Ser. A* 57 (1994) 295–304. [MR1297004](#) (95h:54006)
  30. T. Kubiak, On fuzzy topologies, Ph.D. thesis, UAM, Poznań, 1985.
  31. T. Kubiak, On extremally disconnected subspaces, *Fasc. Math.* 19 (1990) 143–145. [MR1100180](#) (92b:54077)
  32. T. Kubiak, Separation axioms: extension of mappings and embedding of spaces, in: U. Höhle, S.E. Rodabaugh (Eds.), *Mathematics of Fuzzy Sets: Logi Topology and Measure Theory*, in: *The Handbooks of Fuzzy Sets Series*, vol. 3, Kluwer, Dordrecht, 1999, pp. 433–479. [MR1788906](#)
  33. T. Kubiak, Second open question, in: S.E. Rodabaugh, E.P. Klement, U. Höhle (Eds.), *Applications of Category Theory to Fuzzy Subsets*, Kluwer, Dordrech 1992, p. 349. [MR1154566](#) (92k:04006)
  34. E.P. Lane, A sufficient condition for the insertion of a continuous function, *Proc. Amer. Math. Soc.* 49 (1975) 90–94. [MR0362147](#) (50 #14589)
  35. E.P. Lane, Insertion of a continuous function, *Topology Proc.* 4 (1979) 463–478. [MR0598287](#) (82g:54020)
  36. E.P. Lane, Lebesgue sets and insertion of a continuous function, *Proc. Amer. Math. Soc.* 87 (1983) 539–542. [MR0684654](#) (84g:54013)
  37. J. Mack, Countable paracompactness and weak normality properties, *Trans. Amer. Math. Soc.* 148 (1970) 265–272. [MR0259856](#) (41 #4485)
  38. J. Paseka, P. Sekanina, A note on extremally disconnected frames, *Acta Univ.*

- Carolin. Math. Phys. 31 (1990) 75–84. [MR1101419 \(92f:54035\)](#)
39. J. Picado, A. Pultr, Locales Treated Mostly in a Covariant Way, Textos de Matemática, vol. 41, Universidade de Coimbra, 2008. [MR2459570 \(2010d:06012\)](#)
  40. J. Picado, A. Pultr, Frames and Locales: Topology without Points, Frontiers in Mathematics, vol. 28, Springer, Basel, 2012. [MR2868166 \(2012j:54002\)](#)
  41. G.L. Seever, Measures on  $F$ -spaces, Trans. Amer. Math. Soc. 133 (1968) 267–280. [MR0226386 \(37 #1976\)](#)
  42. M. Singal, A. Singal, Almost normal and almost completely regular spaces, Kyungpook Math. J. 25 (1970) 141–152. [MR0275354 \(43 #1111\)](#)
  43. M. Singal, A. Singal, Mildly normal spaces, Kyungpook Math. J. 13 (1973) 27–31. [MR0362215 \(50 #14657\)](#)
  44. M.H. Stone, Boundedness properties in function lattices, Canad. J. Math. 1 (1949) 176–186. [MR0029091 \(10,546a\)](#)
  45. H. Tietze, Über Funktionen, die auf einer abgeschlossenen Menge stetig sind, J. Reine Angew. Math. 145 (1915) 9–14.
  46. H. Tong, Some characterizations of normal and perfectly normal spaces, Duke Math. J. 19 (1952) 289–292. [MR0050265 \(14,304b\)](#)
  47. P.S. Urysohn, Über die Mächtigkeit der zusammenhängenden Mengen, Math. Ann. 94 (1925) 262–295. [MR1512258](#)
  48. A.C. Zaanen, Riesz Spaces II, North-Holland, Amsterdam, 1983. [MR0704021 \(86b:46001\)](#)

*Note: This list reflects references listed in the original paper as accurately as possible with no attempt to correct errors.*