

Acknowledgements

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References

- Andrade, J., Kemps, E., Werniers, Y., May, J., & Szmalec, A. (2002). Insensitivity of visual short-term memory to irrelevant visual information. *Quarterly Journal of Experimental Psychology*, *55*(3), 753-774. <https://doi.org/10.1080/02724980143000541>
- Barrouillet, P., Bernardin, S., & Camos, V. (2004). Time constraints and resource sharing in adults' working memory spans. *Journal of Experimental Psychology: General*, *133*(1), 83-100. <https://doi.org/10.1037/0096-3445.133.1.83>
- Barry, T. J., Griffith, J. W., De Rossi, S., & Hermans, D. (2014). Meet the Fribbles: Novel stimuli for use within behavioural research. *Frontiers in Psychology*, *5*, 103. <https://doi.org/10.3389/fpsyg.2014.00103>
- Berman, M. G., Jonides, J., & Lewis, R. L. (2009). In search of decay in verbal short-term memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *35*(2), 317-333. <https://doi.org/10.1037/a0014873>
- Blalock, L. D. (2013). Mask similarity impacts short-term consolidation in visual working memory. *Psychonomic Bulletin & Review*, *20*(6), 1290-1295. <https://doi.org/10.3758/s13423-013-0461-9>
- Borst, G., Ganis, G., Thompson, W. L., Kosslyn, S. M. (2012). Representations in mental imagery and working memory: Evidence from different types of visual masks. *Memory & Cognition*, *40*(2), 204-217. <https://doi.org/10.3758/s13421-011-0143-7>
- Brady, T. F., Konkle, T., & Alvarez, G. A. (2009). Compression in visual short-term memory: Using statistical regularities to form more efficient memory representations. *Journal of Experimental Psychology: General*, *138*(4), 487-502. <https://doi.org/10.1037/a0016797>

- Brady, T. F., Konkle, T., & Alvarez, G. A. (2011). A review of visual memory capacity: Beyond individual items and toward structured representations. *Journal of Vision*, *11*(5), 1-34. <https://doi.org/10.1167/11.5.4>
- Brown, G. D. A., Neath, I., & Chater, N. (2007). A temporal ratio model of memory. *Psychological Review*, *114*(3), 539-576. <https://doi.org/10.1037/0033-295X.114.3.539>
- Campoy, G. (2012). Evidence for decay in verbal short-term memory: A commentary on Berman, Jonides, and Lewis (2009). *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *38*(4), 1129-1136. <https://doi.org/10.1037/a0026934>
- Clapp, W. C., Rubens, M. T., & Gazzaley, A. (2010). Mechanisms of working memory disruption by external interference. *Cerebral Cortex*, *20*(4), 859-872. <https://doi.org/10.1093/cercor/bhp150>
- Della Sala, S., Gray, C., Baddeley, A., Allamano, N., & Wilson, L. (1999). Pattern span: A tool for unwinding visuo-spatial memory. *Neuropsychologia*, *37*(10), 1189-1199. [https://doi.org/10.1016/S0028-3932\(98\)00159-6](https://doi.org/10.1016/S0028-3932(98)00159-6)
- Farrell, S., Oberauer, K., Greaves, M., Pasiecznik, K., Lewandowsky, S., & Jarrold, C. (2016). A test of interference versus decay in working memory: Varying distraction within lists in a complex span task. *Journal of Memory and Language*, *90*, 66-87. <https://doi.org/10.1016/j.jml.2016.03.010>
- Geiger, S. M., & Lewandowsky, S. (2008). Temporal isolation does not facilitate forward serial recall – or does it? *Memory & Cognition*, *36*(5), 957-967. <https://doi.org/10.3758/MC.36.5.957>
- Gold, J. M., Murray, R. F., Sekuler, A. B., Bennett, P. J., & Sekuler, R. (2005). Visual memory decay is deterministic. *Psychological Science*, *16*(10), 769-774. <https://doi.org/10.1111/j.1467-9280.2005.01612.x>

- Hesse, C., & Franz, V. H. (2010). Grasping remembered objects: Exponential decay of the visual memory. *Vision Research*, 50(24), 2642–2650.
<https://doi.org/10.1016/j.visres.2010.07.026>
- Hitch, G. J., Allen, R. J., & Baddeley, A. D. (2020). Attention and binding in visual working memory: Two forms of attention and two kinds of buffer storage. *Attention, Perception, & Psychophysics*, 82, 280-293. <https://doi.org/10.3758/s13414-019-01837-x>
- Jarmasz, J., & Hollands, J. G. (2009). Confidence intervals in repeated-measures designs: The number of observations principle. *Canadian Journal of Experimental Psychology*, 63(2), 124-138. <https://doi.org/10.1037/a0014164>
- JASP Team (2018). JASP (Version 0.9.0.1) [Computer software]. Retrieved from <https://jasp-stats.org/>
- Johnson, J. S., Spencer, J. P., Luck, S. J., & Schöner, G. (2009). A dynamic neural field model of visual working memory and change detection. *Psychological Science*, 20(5), 568-577. <https://doi.org/10.1111/j.1467-9280.2009.02329.x>
- Kahana, M. J., & Sekuler, R. (2002). Recognizing spatial patterns: A noisy exemplar approach. *Vision Research*, 42(18), 2177-2192. [https://doi.org/10.1016/S0042-6989\(02\)00118-9](https://doi.org/10.1016/S0042-6989(02)00118-9)
- Krill, D., Avidan, G., & Pertzov, Y. (2018). The rapid forgetting of faces. *Frontiers in Psychology*, 9, 1319. <https://doi.org/10.3389/fpsyg.2018.01319>
- Lewandowsky, S., Oberauer, K., & Brown, G. D. A. (2009). No temporal decay in verbal short-term memory. *Trends in Cognitive Sciences*, 13(3), 120-126.
<https://doi.org/10.1016/j.tics.2008.12.003>
- Lin, P.-H., & Luck, S. J. (2009). The influence of similarity on visual working memory representations. *Visual Cognition*, 17(3), 356-372.
<https://doi.org/10.1080/13506280701766313>

- Logie, R. H., Brockmole, J. R., & Vandenbergue, A. R. E. (2009). Bound feature combinations in visual short-term memory and fragile but influence long-term learning. *Visual Cognition, 17*(1-2), 160-179.
<https://doi.org/10.1080/13506280802228411>
- Logie, R. H. & Marchetti, C. (1991). Visuo-spatial working memory: Visual, spatial or central executive? In R. H. Logie & M. Denis (Eds.), *Mental images in human cognition* (pp. 105-115). Amsterdam: Elsevier. [http://dx.doi.org/10.1016/S0166-4115\(08\)60507-5](http://dx.doi.org/10.1016/S0166-4115(08)60507-5)
- Lohmann, J., Herbort, O., & Butz, M. V. (2013). Modeling the temporal dynamics of visual working memory. *Cognitive Systems Research, 24*, 80-86.
<https://doi.org/10.1016/j.cogsys.2012.12.009>
- Magnussen, S., & Greenlee, M. W. (1999). The psychophysics of perceptual memory. *Psychological Research, 62*(2-3), 81–92. <https://doi.org/10.1007/s004260050043>
- Magnussen, S., Greenlee, M. W., Baumann, O., & Endestad, T. (2010). Visual perception memory. In L. Bäckman & L. Nyberg (Eds.), *Memory, aging and the brain: A Festschrift in honour of Lars-Göran Nilsson* (pp. 53–75). Hove, UK: Psychology Press.
<https://doi.org/10.4324/9780203866665>
- Makovski, T., & Jiang, Y. V. (2008). Proactive interference from items previously stored in visual working memory. *Memory & Cognition, 36*(1), 43-52.
<https://doi.org/10.3758/MC.36.1.43>
- Makovski, T., Shim, W. M., & Jiang, Y. V. (2006). Interference from filled delays on visual change detection. *Journal of Vision, 6*(12), 1459-1470. <https://doi.org/10.1167/6.12.11>
- Makovski, T., Watson, L. M., Koutstaal, W., & Jiang, Y. V. (2010). Method matters: Systematic effects of testing procedure on visual working memory sensitivity. *Journal*

- of *Experimental Psychology: Learning, Memory, and Cognition*, 36(6), 1466-1479.
<https://doi.org/10.1037/a0020851>
- Mate, J., & Baqués, J. (2009). Visual similarity at encoding and retrieval in an item recognition task. *Quarterly Journal of Experimental Psychology*, 62(7), 1277-1284.
<https://doi.org/10.1080/17470210802680769>
- Matsukura, M., Luck, S. J., & Vecera, S. P. (2007). Attention effects during visual short-term memory maintenance: Protection or prioritization? *Perception & Psychophysics*, 69(8), 1422-1434. <https://doi.org/10.3758/BF03192957>
- McKeown, D., Holt, J., Delvenne, J-F., Smith, A., & Griffiths, B. (2014). Active versus passive maintenance of visual nonverbal memory. *Psychonomic Bulletin & Review*, 21(4), 1041-1047. <https://doi.org/10.3758/s13423-013-0574-1>
- Mercer, T. (2014). The loss of short-term visual representations over time: Decay or temporal distinctiveness? *Journal of Experimental Psychology: Human Perception and Performance*, 40(6), 2281-2288. <https://doi.org/10.1037/a0038141>
- Mercer, T. (2018). Retroactive interference in visual short-term memory. *Experimental Psychology*, 65(3), 139-148. <https://doi.org/10.1027/1618-3169/a000401>
- Mercer, T., & Duffy, P. (2015). The loss of residual visual memories over the passage of time. *Quarterly Journal of Experimental Psychology*, 68(2), 242-248.
<https://doi.org/10.1080/17470218.2014.975256>
- Morey, C. C., Cong, Y., Zheng, Y., Price, M., & Morey, R. D. (2015). The color-sharing bonus: Roles of perceptual organization and attentive processes in visual working memory. *Archives of Scientific Psychology*, 3(1), 18-29.
<https://doi.org/10.1037/arc0000014>

- Nimmo, L. M., & Lewandowsky, S. (2006). Distinctiveness revisited: Unpredictable temporal isolation does not benefit short-term serial recall of heard or seen events. *Memory & Cognition*, *34*(6), 1368-1375. <https://doi.org/10.3758/BF03193278>
- Nosofsky, R. M., & Kantner, J. (2006). Exemplar similarity, study list homogeneity, and short-term perceptual recognition. *Memory & Cognition*, *34*(1), 112-124. <https://doi.org/10.3758/BF03193391>
- Oberauer, K., & Lewandowsky, S. (2013). Evidence against decay in verbal working memory. *Journal of Experimental Psychology: General*, *142*(2), 380-411. doi:10.1037/a0029588
- Oberauer, K., & Lewandowsky, S. (2014). Further evidence against decay in working memory. *Journal of Memory and Language*, *73*, 15-30. <https://doi.org/10.1016/j.jml.2014.02.003>
- Oberauer, K., Lewandowsky, S., Awh, E., Brown, G. D. A., Conway, A., Cowan, N., ... Ward, G. (2018). Benchmarks for models of short-term and working memory. *Psychological Bulletin*, *144*(9), 855-958. <https://doi.org/10.1037/bul0000153>
- Oberauer, K., Lewandowsky, S., Farrell, S., Jarrold, C., & Greaves, M. (2012). Modeling working memory: An interference model of complex span. *Psychonomic Bulletin & Review*, *19*(5), 779-819. <https://doi.org/10.3758/s13423-012-0272-4>
- Parmentier, F. B. R., Tremblay, S., & Jones, D. M. (2004). Exploring the suffix effect in serial visuospatial short-term memory. *Psychonomic Bulletin & Review*, *11*(2), 289-295. <https://doi.org/10.3758/BF03196572>
- Pertsov, Y., Bays, P. M., Joseph, S., & Husain, M. (2013). Rapid forgetting prevented by retrospective attention cues. *Journal of Experimental Psychology: Human Perception and Performance*, *39*(5), 1224-1231. <https://doi.org/10.1037/a0030947>

- Pertsov, Y., Manohar, S., & Husain, M. (2017). Rapid forgetting results from competition over time between items in visual working memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 43(4), 528-536.
<https://doi.org/10.1037/xlm0000328>
- Peterson, D. J., & Berryhill, M. E. (2013). The Gestalt principle of similarity benefits visual working memory. *Psychonomic Bulletin & Review*, 20(6), 1282-1289.
<https://doi.org/10.3758/s13423-013-0460-x>
- Postle, B. R., D'Esposito, M., & Corkin, S. (2005). Effects of verbal and nonverbal interference on spatial and object visual working memory. *Memory & Cognition*, 33(2), 203-212. <https://doi.org/10.3758/BF03195309>
- Rademaker, R. L., Park, Y. E., Sack, A. T., & Tong, F. (2018). Evidence of gradual loss of precision for simple features and complex objects in visual working memory. *Journal of Experimental Psychology: Human Perception and Performance*, 44(6), 925-940.
<https://doi.org/10.1037/xhp0000491>
- Ricker, T. J., & Cowan, N. (2010). Loss of visual working memory within seconds: The combined use of refreshable and non-refreshable features. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 36(6), 1355-1368.
<https://doi.org/10.1037/a0020356>
- Ricker, T. J., & Cowan, N. (2014). Differences between presentation methods in working memory procedures: A matter of working memory consolidation. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 40(2), 417-428.
<https://doi.org/10.1037/a0034301>
- Ricker, T. J., Sandry, J., Vergauwe, E., & Cowan, N. (2020). Do familiar memory items decay? *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 46(1), 60-76. <https://doi.org/10.1037/xlm0000719>

- Ricker, T.J., Spiegel, L. R., & Cowan, N. (2014). Time-based loss in visual short-term memory is from trace decay, not temporal distinctiveness. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 40(6), 1510-1523.
<https://doi.org/10.1037/xlm0000018>
- Ricker, T., J., Vergauwe, E., & Cowan, N. (2016). Decay theory of immediate memory: From Brown (1958) to today (2014). *Quarterly Journal of Experimental Psychology*, 69(10), 1969-1995. <https://doi.org/10.1080/17470218.2014.914546>
- Sakai, K., & Inui, T. (2001). Characteristics of information decay in short-term visual memory and a diffusion model. *Japanese Journal of Psychology*, 72(5), 404-412.
<https://doi.org/10.4992/jjpsy.72.404>
- Sanocki, T., & Sulman, N. (2011). Color relations increase the capacity of visual short-term memory. *Perception*, 40(6), 635-648. <https://doi.org/10.1068/p6655>
- Saults, J. S., & Cowan, N. (2007). A central capacity limit to the simultaneous storage of visual and auditory arrays in working memory. *Journal of Experimental Psychology: General*, 136(4), 663-684. <https://doi.org/10.1037/0096-3445.136.4.663>
- Shimi, A., & Logie, R. H. (2019). Feature binding in short-term memory and long-term learning. *Quarterly Journal of Experimental Psychology*, 72(6), 1387-1400.
<https://doi.org/10.1177/1747021818807718>
- Shin, H., Zou, Q., & Ma, W. J. (2017). The effects of delay duration on visual working memory for orientation. *Journal of Vision*, 17(14), 1-24.
<https://doi.org/10.1167/17.14.10>
- Shipstead, Z., & Engle, R. W. (2013). Interference within the focus of attention: Working memory tasks reflect more than temporary maintenance. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 39(1), 277-289.
<https://doi.org/10.1037/a0028467>

- Sims, C. R., Jacobs, R. A., & Knill, D. C. (2012). An ideal observer analysis of visual working memory. *Psychological Review*, *119*(4), 807-830.
<https://doi.org/10.1037/a0029856>
- Smallwood, J., & Schooler, J. W. (2015). The science of mind wandering: Empirically navigating the stream of consciousness. *Annual Review of Psychology*, *66*, 487-518.
<https://doi.org/10.1146/annurev-psych-010814-015331>
- Smith, A. V., McKeown, D., & Bunce, D. (2017). Time manages interference in visual short-term memory. *Memory*, *25*(8), 1117-1128.
<https://doi.org/10.1080/09658211.2016.1270967>
- Snodgrass, J. G., Levy-Berger, G., & Haydon, M. (1985). *Human experimental psychology*. New York, NY: Oxford University Press.
- Soemer, A. (2019). Task-unrelated thoughts and forgetting in working memory. *Journal of Memory and Language*, *106*, 118-134. <https://doi.org/10.1016/j.jml.2019.03.004>
- Souza, A. S., & Oberauer, K. (2015). Time-based forgetting in visual working memory reflects temporal distinctiveness, not decay. *Psychonomic Bulletin & Review*, *22*(1), 156-162. <https://doi.org/10.3758/s13423-014-0652-z>
- Souza, A. S., & Oberauer, K. (2016). In search of the focus of attention in working memory: 13 years of the retro-cue effect. *Attention, Perception, & Psychophysics*, *78*(7), 1839-1860. <https://doi.org/10.3758/s13414-016-1108-5>
- Sun, S. Z., Fidalgo, C., Barense, M. D., Lee, A. C. H., Cant, J. S., & Ferber, S. (2017). Erasing and blurring memories: The differential impact of interference on separate aspects of forgetting. *Journal of Experimental Psychology: General*, *146*(11), 1606-1630. <http://dx.doi.org/10.1037/xge0000359>

Tremblay, S., Nicholls, A. P., Parmentier, F. B. R., & Jones, D. M. (2005). Visual distraction and visuo-spatial memory: A sandwich effect. *Memory*, *13*(3-4), 357-363.

<https://doi.org/10.1080/09658210344000422>

Unsworth, N., & Robison, M. K. (2016). The influence of lapses of attention on working memory capacity. *Memory & Cognition*, *44*(2), 188-196.

<https://doi.org/10.3758/s13421-015-0560-0>

Viswanathan, S., Perl, D. R., Visscher, K. M., Kahana, M. J., & Sekuler, R. (2010).

Homogeneity computation: How interitem similarity in visual short-term memory alters recognition. *Psychonomic Bulletin & Review*, *17*(1), 59-65.

<https://doi.org/10.3758/PBR.17.1.59>

Vogel, E. K., Woodman, G. F., & Luck, S. J. (2006). The time course of consolidation in visual working memory. *Journal of Experimental Psychology: Human Perception & Performance*, *32*(6), 1436-1451.

<https://doi.org/10.1037/0096-1523.32.6.1436>

Wagenmakers, E.-J., Love, J., Marsman, M., Jamil, T., Ly, A., Verhagen, J., ... Morey, R. D. (2018). Bayesian inference for psychology. Part II: Example applications with JASP.

Psychonomic Bulletin & Review, *25*(1), 58-76. [https://doi.org/10.3758/s13423-017-1323-](https://doi.org/10.3758/s13423-017-1323-7)

[7](https://doi.org/10.3758/s13423-017-1323-7)

Xie, W., & Zhang, W. (2017). Familiarity increases the number of remembered Pokémon in visual short-term memory. *Memory & Cognition*, *45*(4), 677-689.

<https://doi.org/10.3758/s13421-016-0679-7>

Zhang, Q., Li, S., Wang, X., & Che, X. (2016). The effects of direction similarity in visual working memory: Behavioural and event-related potential studies. *Quarterly Journal of Experimental Psychology*, *69*(9), 1812-1830.

<https://doi.org/10.1080/17470218.2015.1100206>

Zhang, W., & Luck, S. J. (2009). Sudden death and gradual decay in visual working memory.

Psychological Science, 20(4), 423-428. [https://doi.org/10.1111/j.1467-](https://doi.org/10.1111/j.1467-9280.2009.02322.x)

[9280.2009.02322.x](https://doi.org/10.1111/j.1467-9280.2009.02322.x)

