1 SUMMARY OF SURVEYED PAPERS

| Ref | Year | Venue | Encoding | Objective Function | Content | | | | |
|-----------|--------------|--|------------------------------|--|------------------------------------|--|--|--|--|
| GAME BITS | | | | | | | | | |
| [1] | 2018 | EvoApplications | Indirect | Direct - Theory Driven | Textures | | | | |
| [2] | 2018 | EvoApplications | Indirect | Direct - Theory Driven | Textures | | | | |
| [3] | 2020 | Multimedia Tools and Applications | Indirect | Direct - Theory Driven | Textures | | | | |
| [4] | 2012 | T-CIAIG | Indirect | Interactive - Implicit | Sound | | | | |
| [5] | 2013 | PCGames | Indirect | Interactive - Implicit | Weapons | | | | |
| [6] | 2015 | CIG | Indirect | Simulation - Static | Weapons | | | | |
| [7] | 2016 | GEM | Indirect | Direct - Theory Driven | Weapons | | | | |
| [8] | 2021 | CISTI | Indirect | Direct - Theory | Vegetation | | | | |
| [0] | 2012 | | GAME SPAC | | T. : | | | | |
| [9] | 2012 | Soft Computing | Indirect | Direct - Theory Driven | Terrains | | | | |
| [10] | 2012 | CIG | Indirect | Direct - Theory Driven | Terrains | | | | |
| [11] | 2016 | EvoCOP EvoCOP | Indirect Direct and Indirect | Direct - Theory Driven Simulation - Static and Direct - Theory Driven | Terrains Shooter Maps | | | | |
| [13] | 2014 | CIG | Direct | Simulation - Static | Shooter Maps | | | | |
| [14] | 2015 | CEC | Direct | Interactive - Explicit | Shooter Maps | | | | |
| [15] | 2017 | CIG | Direct | Simulation - Static | Shooter Maps | | | | |
| [16] | 2018 | TOG | Direct | Simulation - Static and Interactive - Explicit | Shooter Maps | | | | |
| [17] | 2012 | GAME-ON | Indirect | Simulation - Static | Strategic Maps | | | | |
| [18] | 2012 | EvoCOP | Indirect | Direct - Theory Driven | Strategic Maps | | | | |
| [19] | 2013 | Genet. Program. Evolvable Mach. | Indirect | Direct - Theory Driven | Strategic Maps | | | | |
| [20] | 2013 | GECCO | Direct | Direct - Theory Driven | Strategic Maps | | | | |
| [21] | 2013 | EvoCOP | Indirect | Simulation - Static | Strategic Maps | | | | |
| [22] | 2013 | LSSC | Indirect | Simulation - Static | Strategic Maps | | | | |
| [23] | 2013 | SEED | Indirect | Direct - Theory Driven | Strategic Maps | | | | |
| [24] | 2014 | Natural Computing | Indirect | Simulation - Static | Strategic Maps | | | | |
| [25] | 2014 | CEC | Indirect | Direct - Theory Driven | Strategic Maps | | | | |
| [26] | 2014 | Entertainment Computing | Indirect | Direct - Theory Driven | Strategic Maps | | | | |
| [27] | 2015 | CEC | Indirect | Direct - Theory Driven | Strategic Maps | | | | |
| [28] | 2015 | CEC | Indirect | Direct - Theory Driven | Strategic Maps | | | | |
| [29] | 2017 | CoSECivi | Indirect | Direct - Theory Driven | Strategic Maps | | | | |
| [30] | 2018 | CIG | Indirect | Direct - Theory Driven | Strategic Maps | | | | |
| [21] | 2012 | CDC | GAME SYSTI | | Entites Dalassiassa | | | | |
| [31] | 2012 | SBGames | Direct | Simulation - Static | Entity Behaviour | | | | |
| [32] | 2013 2014 | ECAL SBGames | Indirect Direct | Direct - Theory Simulation - Static | Entity Behaviour | | | | |
| [33] | 2014 | GHITALY | Indirect | Direct - Theory | Entity Behaviour Entity Behaviour | | | | |
| [34] | 2017 | Soft Computing | Direct | Simulation - Static | Entity Behaviour Entity Behaviour | | | | |
| [36] | 2017 | CEC | Indirect | Direct - Theory Driven | Entity Behaviour Entity Behaviour | | | | |
| [37] | 2020 | Multimed. Tools Appl. | Indirect | Interactive - Implicit | Entity Behaviour | | | | |
| [31] | 2020 | | GAME SCENA | * | Zitit, Delia (10a) | | | | |
| [38] | 2011 | T-CIAIG | Direct and Indirect | Direct - Theory Driven and Simulation - Static | Mazes | | | | |
| [39] | 2011 | Computational Intelligence Magazine | Indirect and Direct | Direct - Theory Driven | Mazes | | | | |
| [40] | 2011 | CEC | Direct and Indirect | Direct - Theory Driven | Mazes | | | | |
| [41] | 2011 | CIG | Direct and Indirect | Direct - Theory Driven | Mazes | | | | |
| [42] | 2012 | CIG | Direct and Indirect | Direct - Theory Driven | Mazes | | | | |
| [43] | 2015 | ACALCI | Direct and Indirect | Direct - Theory Driven | Mazes | | | | |
| [44] | 2015 | CGAMES | Direct | Direct - Theory Driven | Mazes | | | | |
| [45] | 2016 | Connection Science | Direct and Indirect | Direct - Theory Driven | Mazes | | | | |
| [46] | 2016 | CEC | Direct | Direct - Theory Driven | Mazes | | | | |

| [47] | 2018 | IIAI-AAI | Direct | Direct - Theory Driven | Mazes |
|-------|------|-------------------------------|--------------|--|----------------|
| [48] | 2013 | CIG | Indirect | Direct - Theory Driven | Physics |
| [49] | 2014 | ACE | Direct | Simulation -Static | Physics |
| [50] | 2014 | CIG | Direct | Simulation - Static | Physics |
| [51] | 2015 | GCCE | Indirect | Interactive - Implicit | Physics |
| [52] | 2016 | EvoCOP | Indirect | Direct - Theory Driven and Simu- | Physics |
| | | | | lation - Static | |
| [53] | 2017 | T-CIAIG | Direct | Simulation - Static | Physics |
| [54] | 2019 | EvoApplications | Indirect | Direct - Theory Driven and Simu- | Physics |
| | | | | lation - Static | |
| [55] | 2019 | IJCCI | Indirect | Simulation - Static | Physics |
| [56] | 2020 | | Direct | Simulation - Static | Physics |
| [57] | 2020 | OLA | Direct | Direct - Theory driven and Simulation - Static | Physics |
| [58] | 2011 | T-CIAIG | Indirect | Simulation - Static | Tracks |
| | 2011 | GECCO | Indirect | | Tracks |
| [59] | | | Indirect | Interactive - Explicit | Tracks |
| [60] | 2015 | Applied Soft Computing IJEEI | | Interactive - Explicit | |
| [61] | 2016 | | Indirect | Direct - Theory Driven | Tracks |
| [62] | 2012 | PCGames PCG Workshop | Indirect | Simulation - Static | Rooms |
| [63] | 2015 | CEEC | Indirect | Simulation - Static | Rooms |
| [64] | 2019 | CoG | Direct | Simulation - Static | Rooms |
| [65] | 2020 | Applied Soft Computing | Direct | Simulation - Static | Rooms |
| [66] | 2020 | FDG | Direct | Simulation - Static | Rooms |
| [67] | 2021 | ToG | Direct | Direct - Data Driven | Rooms |
| [68] | 2012 | ICPS | Indirect | Direct - Theory Driven | Dungeon |
| [69] | 2016 | EvoCOP | Indirect | Direct - Theory Driven | Dungeon |
| [70] | 2017 | CEEC | Indirect | Direct - Theory Driven | Dungeon |
| [71] | 2018 | Computers | Indirect | Direct - Theory Driven | Dungeon |
| [72] | 2018 | CEC | Indirect | Direct - Theory | Dungeon |
| [73] | 2018 | CIG | Direct | Direct - Theory | Dungeon |
| [74] | 2018 | SBGames | Indirect | Direct - Theory | Dungeon |
| [75] | 2018 | ToG | Direct | Direct - Theory | Dungeon |
| [76] | 2020 | Applied Intelligence | Direct | Direct - Theory | Dungeon |
| [77] | 2021 | Expert Syst. Appl. | Indirect | Simulation - Static | Dungeon |
| [78] | 2011 | ACE | Direct | Direct -Theory Driven | Timeline |
| [79] | 2013 | CIG | Indirect | Direct - Theory Driven | Timeline |
| [80] | 2013 | DPG | Indirect | Direct - Theory Driven | Timeline |
| [81] | 2014 | EvoCOP | Indirect | Direct - Theory Driven | Timeline |
| [82] | 2015 | EvoCOP | Indirect | Simulation - Static | Timeline |
| [83] | 2017 | CSIEC | Indirect | Direct - Theory | Timeline |
| [84] | 2018 | FDG | Indirect | Direct - Theory and Simulation - Static | Timeline |
| [85] | 2018 | EECSI | Indirect | Direct - Theory | Timeline |
| [86] | 2018 | GECCO | Indirect | Simulation - Static | Timeline |
| [87] | 2019 | CoG | Indirect | Simulation - Static | Timeline |
| [88] | 2019 | JPCS | Indirect | Simulation - Static | Timeline |
| [89] | 2020 | CoG | Indirect | Simulation - Static | Timeline |
| [90] | 2020 | GECCO | Direct | Simulation - Static | Timeline |
| [91] | 2012 | GI | Indirect | Direct - Theory Driven | Stories |
| [71] | 2012 | <u> </u> | GAME DESIG | <u> </u> | Siones |
| [92] | 2014 | IJAIT | Indirect | Simulation - Static | System Design |
| [93] | 2015 | | Indirect | Simulation - Static | System Design |
| [94] | 2016 | EvoCOP | Indirect | Simulation - Static | System Design |
| [95] | 2012 | EvoCOP | Indirect | Direct - Theory | Camera Control |
| F = 1 | | | - | | |

REFERENCES

^[1] J. Kowalski, A. Liapis, and Ł. Żarczyński, "Mapping chess aesthetics onto procedurally generated chess-like games," in International Conference on the

Applications of Evolutionary Computation. Springer, 2018, pp. 325–341.

[2] A. Liapis, "Recomposing the pokémon color palette," in *International Conference on the Applications of Evolutionary Computation*. Springer, 2018, pp. 308-324.

- [3] A. Bernardi, D. Gadia, D. Maggiorini, C. E. Palazzi, and L. A. Ripamonti, "Procedural generation of materials for real-time rendering," *Multimedia Tools and Applications*, pp. 1–22, 2020.
- [4] D. Plans and D. Morelli, "Experience-driven procedural music generation for games," *IEEE Transactions on Computational Intelligence and AI in Games*, vol. 4, no. 3, pp. 192–198, 2012.
- [5] E. McDuffee and A. Pantaleev, "Team blockhead wars: Generating fps weapons in a multiplayer environment," in *Proceedings of the Second Workshop on Procedural Content Generation in Games*, 2013.
- [6] D. Gravina and D. Loiacono, "Procedural weapons generation for unreal tournament iii," in 2015 IEEE Games entertainment media conference (GEM). IEEE, 2015, pp. 1–8.
- [7] D. Gravina, A. Liapis, and G. N. Yannakakis, "Constrained surprise search for content generation," in 2016 IEEE Conference on Computational Intelligence and Games (CIG). IEEE, 2016, pp. 1–8.
- [8] C. Mora, S. Jardim, and J. Valente, "Flora generation and evolution algorithm for virtual environments," in 2021 16th Iberian Conference on Information Systems and Technologies (CISTI). IEEE, 2021, pp. 1–6.
- [9] M. Frade, F. F. de Vega, and C. Cotta, "Automatic evolution of programs for procedural generation of terrains for video games," *Soft Computing*, vol. 16, no. 11, pp. 1893–1914, 2012.
- [10] —, "Aesthetic terrain programs database for creativity assessment," in 2012 IEEE Conference on Computational Intelligence and Games (CIG). IEEE, 2012, pp. 350–354.
- [11] A. Pech, C.-P. Lam, P. Hingston, and M. Masek, "Using isovists to evolve terrains with gameplay elements," in *European Conference on the Applications of Evolutionary Computation*. Springer, 2016, pp. 636–652.
- [12] L. Cardamone, G. N. Yannakakis, J. Togelius, and P. L. Lanzi, "Evolving interesting maps for a first person shooter," in *European Conference on the Applications of Evolutionary Computation*. Springer, 2011, pp. 63–72.
- [13] P. L. Lanzi, D. Loiacono, and R. Stucchi, "Evolving maps for match balancing in first person shooters," in 2014 IEEE Conference on Computational Intelligence and Games. IEEE, 2014, pp. 1–8.
- [14] P. T. Ølsted, B. Ma, and S. Risi, "Interactive evolution of levels for a competitive multiplayer fps," in 2015 IEEE Congress on Evolutionary Computation (CEC). IEEE, 2015, pp. 1527–1534.
- [15] D. Loiacono and L. Arnaboldi, "Fight or flight: Evolving maps for cube 2 to foster a fleeing behavior," in 2017 IEEE Conference on Computational Intelligence and Games (CIG). IEEE, 2017, pp. 199–206.
- [16] —, "Multiobjective evolutionary map design for cube 2: Sauerbraten," *IEEE Transactions on Games*, vol. 11, no. 1, pp. 36–47, 2018.
- [17] R. Lara-Cabrera, C. Cotta, and A. J. Fernández-Leiva, "Procedural map generation for a rts game," in 13th International GAME-ON Conference on Intelligent Games and Simulation. Malaga (Spain): Eurosis, 2012, pp. 53–58.
- [18] T. Mahlmann, J. Togelius, and G. N. Yannakakis, "Spicing up map generation," in European Conference on the Applications of Evolutionary Computation. Springer, 2012, pp. 224–233.
- [19] J. Togelius, M. Preuss, N. Beume, S. Wessing, J. Hagelbäck, G. N. Yannakakis, and C. Grappiolo, "Controllable procedural map generation via multiobjective evolution," *Genetic Programming and Evolvable Machines*, vol. 14, no. 2, pp. 245–277, 2013.
- [20] A. Liapis, G. N. Yannakakis, and J. Togelius, "Enhancements to constrained novelty search: Two-population novelty search for generating game content," in *Proceedings of the 15th annual conference on Genetic and evolutionary computation*, 2013, pp. 343–350.
- [21] R. Lara-Cabrera, C. Cotta, and A. J. Fernández-Leiva, "A procedural balanced map generator with self-adaptive complexity for the real-time strategy game planet wars," in *European Conference on the Applications of Evolutionary Computation*. Springer, 2013, pp. 274–283.
- [22] ——, "Using self-adaptive evolutionary algorithms to evolve dynamism-oriented maps for a real time strategy game," in *International Conference on Large-Scale Scientific Computing*. Springer, 2013, pp. 256–263.
- [23] R. Lara-Cabrera, C. Cotta, A. J. Fernández-Leiva et al., "Evolving aesthetic maps for a real time strategy game," 2013.
- [24] R. Lara-Cabrera, C. Cotta, and A. J. Fernández-Leiva, "On balance and dynamism in procedural content generation with self-adaptive evolutionary algorithms," *Natural Computing*, vol. 13, no. 2, pp. 157–168, 2014.
- [25] R. Lara-Cabrera, C. Cotta, and A. J. Fernändez-Leiva, "A self-adaptive evolutionary approach to the evolution of aesthetic maps for a rts game," in 2014 IEEE Congress on Evolutionary Computation (CEC). IEEE, 2014, pp. 298–304.
- [26] R. Lara-Cabrera, C. Cotta, and A. Fernández-Leiva, "Geometrical vs topological measures for the evolution of aesthetic maps in a rts game," *Entertainment Computing*, vol. 5, no. 4, pp. 251–258, 2014.
- [27] G. A. Barros and J. Togelius, "Balanced civilization map generation based on open data," in 2015 IEEE Congress on Evolutionary Computation (CEC). IEEE, 2015, pp. 1482–1489.
- [28] A. Liapis, G. N. Yannakakis, and J. Togelius, "Constrained novelty search: A study on game content generation," Evolutionary computation, vol. 23, no. 1, pp. 101–129, 2015.
- [29] R. Lara-Cabrera, V. Rodríguez-Fernández, J. Paz-Sedano, and D. Camacho, "Procedural generation of balanced levels for a 3d paintball game." in *CoSECivi*, 2017, pp. 43–55.
- [30] J. Kowalski, R. Miernik, P. Pytlik, M. Pawlikowski, K. Piecuch, and J. Sekowski, "Strategic features and terrain generation for balanced heroes of might and magic iii maps," in 2018 IEEE Conference on Computational Intelligence and Games (CIG). IEEE, 2018, pp. 1–8.
- [31] A. S. Ruela and F. G. Guimaraes, "Evolving battle formations in massively multiplayer online strategy games," in SBC-Proc. of the Brazilian Symposium on Games and Digital Entertainment-SBGames, 2012, pp. 49–55.
- [32] A. Guarneri, D. Maggiorini, L. Ripamonti, and M. Trubian, "Golem: generator of life embedded into mmos," in ECAL 2013: The Twelfth European Conference on Artificial Life. MIT press, 2013, pp. 585–592.
- [33] A. S. Ruela and F. G. Guimaraes, "Coevolutionary procedural generation of battle formations in massively multiplayer online strategy games," in 2014 Brazilian Symposium on Computer Games and Digital Entertainment. IEEE, 2014, pp. 89–98.
- [34] D. Norton, L. A. Ripamonti, M. Ornaghi, D. Gadia, and D. Maggiorini, "Monsters of darwin: A strategic game based on artificial intelligence and genetic algorithms," in *GHITALY*, vol. 1956. CEUR-WS, 2017.
- [35] A. S. Ruela and F. G. Guimarães, "Procedural generation of non-player characters in massively multiplayer online strategy games," Soft Computing, vol. 21, no. 23, pp. 7005–7020, 2017.
- [36] J. A. Brown, D. Ashlock, S. Houghten, and A. Romualdo, "Evolutionary graph compression and diffusion methods for city discovery in role playing games," in 2020 IEEE Congress on Evolutionary Computation (CEC). IEEE, 2020, pp. 1–8.
- [37] L. A. Ripamonti, F. Distefano, M. Trubian, D. Maggiorini, and D. Gadia, "Dragon: diversity regulated adaptive generator online," *Multimedia Tools and Applications*, vol. 80, no. 26, pp. 34 933–34 969, 2021.
- [38] D. Ashlock, C. Lee, and C. McGuinness, "Search-based procedural generation of maze-like levels," *IEEE Transactions on Computational Intelligence and AI in Games*, vol. 3, no. 3, pp. 260–273, 2011.
- [39] —, "Simultaneous dual level creation for games," IEEE Computational Intelligence Magazine, vol. 6, no. 2, pp. 26–37, 2011.
- [40] C. McGuinness and D. Ashlock, "Decomposing the level generation problem with tiles," in 2011 IEEE Congress of Evolutionary Computation (CEC). IEEE, 2011, pp. 849–856.
- [41] —, "Incorporating required structure into tiles," in 2011 IEEE Conference on Computational Intelligence and Games (CIG'11). IEEE, 2011, pp. 16–23.
- [42] C. McGuinness, "Statistical analyses of representation choice in level generation," in 2012 IEEE Conference on Computational Intelligence and Games (CIG). IEEE, 2012, pp. 312–319.

- [43] A. Pech, P. Hingston, M. Masek, and C. P. Lam, "Evolving cellular automata for maze generation," in *Australasian conference on artificial life and computational intelligence*. Springer, 2015, pp. 112–124.
- [44] P. H. Kim and R. Crawfis, "The quest for the perfect perfect-maze," in 2015 Computer Games: AI, Animation, Mobile, Multimedia, Educational and Serious Games (CGAMES). IEEE, 2015, pp. 65–72.
- [45] A. Pech, M. Masek, C.-P. Lam, and P. Hingston, "Game level layout generation using evolved cellular automata," *Connection Science*, vol. 28, no. 1, pp. 63–82, 2016.
- [46] C. McGuinness, "Multiple pass monte carlo tree search," in 2016 IEEE Congress on Evolutionary Computation (CEC). IEEE, 2016, pp. 1555-1561.
- [47] P. H. Kim and R. Crawfis, "Intelligent maze generation based on topological constraints," in 2018 7th International Congress on Advanced Applied Informatics (IIAI-AAI). IEEE, 2018, pp. 867–872.
- [48] M. Shaker, M. H. Sarhan, O. Al Naameh, N. Shaker, and J. Togelius, "Automatic generation and analysis of physics-based puzzle games," in 2013 IEEE Conference on Computational Inteligence in Games (CIG). IEEE, 2013, pp. 1–8.
- [49] L. Ferreira and C. Toledo, "Generating levels for physics-based puzzle games with estimation of distribution algorithms," in *Proceedings of the 11th Conference on Advances in Computer Entertainment Technology*, 2014, pp. 1–6.
- [50] —, "A search-based approach for generating angry birds levels," in 2014 IEEE Conference on Computational Intelligence and Games. IEEE, 2014, pp. 1–8.
- [51] M. Kaidan, C. Y. Chu, T. Harada, and R. Thawonmas, "Procedural generation of angry birds levels that adapt to the player's skills using genetic algorithm," in 2015 IEEE 4th Global Conference on Consumer Electronics (GCCE). IEEE, 2015, pp. 535–536.
- [52] R. Lara-Cabrera, A. Gutierrez-Alcoba, and A. J. Fernández-Leiva, "A spatially-structured pcg method for content diversity in a physics-based simulation game," in *European Conference on the Applications of Evolutionary Computation*. Springer, 2016, pp. 653–668.
- [53] L. N. Ferreira and C. F. M. Toledo, "Tanager: A generator of feasible and engaging levels for angry birds," *IEEE Transactions on Games*, vol. 10, no. 3, pp. 304–316, 2017.
- [54] L. Calle, J. J. Merelo, A. Mora-García, and J.-M. García-Valdez, "Free form evolution for angry birds level generation," in *International Conference on the Applications of Evolutionary Computation (Part of EvoStar)*. Springer, 2019, pp. 125–140.
- [55] L. Calle, J. J. M. Guervós, M. G. Valdez, and A. M. García, "Speeding up evaluation of structures for the angry birds game." in IJCCI, 2019, pp. 237–244.
- [56] J. Salinas-Hernández and M. Garcia-Valdez, "Procedural generation of levels for the angry birds videogame using evolutionary computation," in *Intuitionistic and Type-2 Fuzzy Logic Enhancements in Neural and Optimization Algorithms: Theory and Applications.* Springer, 2020, pp. 581–592.
- [57] C. López-Rodríguez, A. J. Fernández-Leiva, R. Lara-Cabrera, A. M. Mora, and P. García-Sánchez, "Checking the difficulty of evolutionary-generated maps in a n-body inspired mobile game," in *International Conference on Optimization and Learning*. Springer, 2020, pp. 206–215.
- [58] D. Loiacono, L. Cardamone, and P. L. Lanzi, "Automatic track generation for high-end racing games using evolutionary computation," *IEEE Transactions on Computational Intelligence and AI in Games*, vol. 3, no. 3, pp. 245–259, 2011.
- [59] L. Cardamone, D. Loiacono, and P. L. Lanzi, "Interactive evolution for the procedural generation of tracks in a high-end racing game," in *Proceedings of the* 13th annual conference on Genetic and evolutionary computation, 2011, pp. 395–402.
- [60] L. Cardamone, P. L. Lanzi, and D. Loiacono, "Trackgen: An interactive track generator for torcs and speed-dreams," Applied Soft Computing, vol. 28, pp. 550–558, 2015.
- [61] H. A. Prasetya and N. U. Maulidevi, "Search-based procedural content generation for race tracks in video games." *International Journal on Electrical Engineering & Informatics*, vol. 8, no. 4, 2016.
- [62] J. Togelius, T. Justinussen, and A. Hartzen, "Compositional procedural content generation," in *Proceedings of the The third workshop on Procedural Content Generation in Games*, 2012, pp. 1–4.
- [63] X. Neufeld, S. Mostaghim, and D. Perez-Liebana, "Procedural level generation with answer set programming for general video game playing," in 2015 7th Computer Science and Electronic Engineering Conference (CEEC). IEEE, 2015, pp. 207–212.
- [64] O. Drageset, M. H. Winands, R. D. Gaina, and D. Perez-Liebana, "Optimising level generators for general video game ai," in 2019 IEEE Conference on Games (CoG). IEEE, 2019, pp. 1–8.
- [65] A. Zafar, H. Mujtaba, and M. O. Beg, "Search-based procedural content generation for gvg-lg," Applied Soft Computing, vol. 86, p. 105909, 2020.
- [66] M. Charity, M. C. Green, A. Khalifa, and J. Togelius, "Mech-elites: Illuminating the mechanic space of gvg-ai," in *International Conference on the Foundations of Digital Games*, 2020, pp. 1–10.
- [67] S. Walton, A. Rahat, and J. Stovold, "Evaluating mixed-initiative procedural level design tools using a triple-blind mixed-method user study," *IEEE Transactions on Games*, 2021.
- [68] V. Valtchanov and J. A. Brown, "Evolving dungeon crawler levels with relative placement," in *Proceedings of the Fifth International C* Conference on Computer Science and Software Engineering*, 2012, pp. 27–35.
- [69] J. M. Font, R. Izquierdo, D. Manrique, and J. Togelius, "Constrained level generation through grammar-based evolutionary algorithms," in *European Conference on the Applications of Evolutionary Computation*. Springer, 2016, pp. 558–573.
- [70] J. A. Brown, B. Lutfullin, and P. Oreshin, "Procedural content generation of level layouts for hotline miami," in 2017 9th Computer Science and Electronic Engineering (CEEC). IEEE, 2017, pp. 106–111.
- [71] J. A. Brown, B. Lutfullin, P. Oreshin, and I. Pyatkin, "Levels for hotline miami 2: Wrong number using procedural content generations," *Computers*, vol. 7, no. 2, p. 22, 2018.
- [72] L. T. Pereira, P. V. Prado, and C. Toledo, "Evolving dungeon maps with locked door missions," in 2018 IEEE Congress on Evolutionary Computation (CEC). IEEE, 2018, pp. 1–8.
- [73] A. S. Ruela and K. V. Delgado, "Scale-free evolutionary level generation," in 2018 IEEE Conference on Computational Intelligence and Games (CIG). IEEE, 2018, pp. 1–8.
- [74] —, "Evolving lock-and-key puzzles based on nonlinear player progression and level exploration," SBC-Proceedings of SBGames, pp. 651–654, 2018.
- [75] A. S. Melotti and C. H. V. de Moraes, "Evolving roguelike dungeons with deluged novelty search local competition," *IEEE Transactions on Games*, vol. 11, no. 2, pp. 173–182, 2018.
- [76] A. S. Ruela, K. V. Delgado, and J. Bernardes, "A multi-objective evolutionary approach for the nonlinear scale-free level problem," *Applied Intelligence*, vol. 50, no. 12, pp. 4223–4240, 2020.
- [77] L. T. Pereira, P. V. de Souza Prado, R. M. Lopes, and C. F. M. Toledo, "Procedural generation of dungeons' maps and locked-door missions through an evolutionary algorithm validated with players," *Expert Systems with Applications*, vol. 180, p. 115009, 2021.
- [78] F. Mourato, M. P. dos Santos, and F. Birra, "Automatic level generation for platform videogames using genetic algorithms," in *Proceedings of the 8th International Conference on Advances in Computer Entertainment Technology*, 2011, pp. 1–8.
- [79] D.-F. H. Adrian and S.-G. C. A. Luisa, "An approach to level design using procedural content generation and difficulty curves," in 2013 IEEE Conference on Computational Inteligence in Games (CIG). IEEE, 2013, pp. 1–8.
- [80] S. Dahlskog and J. Togelius, "Patterns as objectives for level generation," in *Design Patterns in Games (DPG), Chania, Crete, Greece (2013)*. ACM Digital Library, 2013.
- [81] ——, "Procedural content generation using patterns as objectives," in *European Conference on the Applications of Evolutionary Computation*. Springer, 2014, pp. 325–336.
- [82] M. Shaker, N. Shaker, J. Togelius, and M. Abou-Zleikha, "A progressive approach to content generation," in European Conference on the Applications of Evolutionary Computation. Springer, 2015, pp. 381–393.

- [83] A. B. Moghadam and M. K. Rafsanjani, "A genetic approach in procedural content generation for platformer games level creation," in 2017 2nd Conference on Swarm Intelligence and Evolutionary Computation (CSIEC). IEEE, 2017, pp. 141–146.
- [84] M. C. Green, A. Khalifa, G. A. Barros, A. Nealen, and J. Togelius, "Generating levels that teach mechanics," in *Proceedings of the 13th International Conference on the Foundations of Digital Games*, 2018, pp. 1–8.
- [85] A. S. Kholimi, A. Hamdani, and L. Husniah, "Automatic game world generation for platformer games using genetic algorithm," in 2018 5th International Conference on Electrical Engineering, Computer Science and Informatics (EECSI). IEEE, 2018, pp. 495–498.
- [86] A. Khalifa, M. C. Green, G. Barros, and J. Togelius, "Intentional computational level design," in *Proceedings of The Genetic and Evolutionary Computation Conference*, 2019, pp. 796–803.
- [87] V. R. Warriar, C. Ugarte, J. R. Woodward, and L. Tokarchuk, "Playmapper: Illuminating design spaces of platform games," in 2019 IEEE Conference on Games (CoG). IEEE, 2019, pp. 1–4.
- [88] P. W. Atmaja, E. P. Mandyartha *et al.*, "Difficulty curve-based procedural generation of scrolling shooter enemy formations," in *Journal of Physics: Conference Series*, vol. 1569, no. 2. IOP Publishing, 2020, p. 022049.
- [89] M. C. Green, L. Mugrai, A. Khalifa, and J. Togelius, "Mario level generation from mechanics using scene stitching," in 2020 IEEE Conference on Games (CoG). IEEE, 2020, pp. 49–56.
- [90] O. Withington, "Illuminating super mario bros: quality-diversity within platformer level generation," in *Proceedings of the 2020 Genetic and Evolutionary Computation Conference Companion*, 2020, pp. 223–224.
- [91] E. M. Fredericks and B. DeVries, "(genetically) improving novelty in procedural story generation," in 2021 IEEE/ACM International Workshop on Genetic Improvement (GI). IEEE, 2021, pp. 39–40.
- [92] Z. Halim, A. R. Baig, and K. Zafar, "Evolutionary search in the space of rules for creation of new two-player board games," *International Journal on Artificial Intelligence Tools*, vol. 23, no. 02, p. 1350028, 2014.
- [93] J. Kowalski and M. Szykuła, "Procedural content generation for gdl descriptions of simplified boardgames," arXiv preprint arXiv:1508.00212, 2015.
- [94] —, "Evolving chess-like games using relative algorithm performance profiles," in *European Conference on the Applications of Evolutionary Computation*. Springer, 2016, pp. 574–589.
- [95] M. Preuss, P. Burelli, and G. N. Yannakakis, "Diversified virtual camera composition," in European Conference on the Applications of Evolutionary Computation. Springer, 2012, pp. 265–274.