**TwoA API Manual**

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# Summary

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| **Document information** | |
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| **Asset information** | |
| Current version | 1.2 |
| Date | 2017.03.22 |
| Deployment side | client-side |
| Programming language | C# |
| Required libraries | Microsoft .NET 3.5 Framework or higher |
| Recommended platform | Windows OS |

# Adaptation Modules

The asset provides two different modules for adaptation and assessment. Modules differ in terms of required input to the asset from a game. In this context, input refers to player’s performance measures such as response time and accuracy. Adaptation module ID should be passed to the TwoA asset in order to indicated the module that should be used.

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| **Adaptation Module 1** | |
| Adatation ID (string type) | “Game difficulty - Player skill” |
| Description | Assess and adapts game difficulty to player skill. Skill ratings are evaluated for individual players. Requires player accuracy and response time. Uses a modified version of the CAP algorithm. |
| Input 1 | Player’s accuracy. The value should have *double* type. The value should be either 0 or 1. The value is 1 if the player successfully completed a game scenario. The value is 0 if the player failed the game scenario. |
| Input 2 | Player’s response time. The value should have *double* type. The duration of time the player required to complete (either successfully or unsuccessfully) a game scenario. Time is measured in milliseconds. |

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| **Adaptation Module 1** | |
| Adatation ID (string type) | “SkillDifficultyElo” |
| Description | Assess and adapts game difficulty to player skill. Skill ratings are evaluated for individual players. Requires player accuracy and response time. Uses a modified version of the CAP algorithm. |
| Input 1 | Player’s accuracy. The value should have *double* type. The value should be between 0 and 1. The value of 0 represents the worst possible player performance in a game scenario. The value of 1 represents the best possible player performance in a game scenario. |

# Rating Scale

Given a player with a skill rating *θ*, the table below shows the player’s expected success rate (column “*P*”) in a scenario with a specific difficulty rating (column “Difficulty rating”). For example, if the player’s skill rating is equal to one (*θ* = 1) then the player has 74% chance of successfully completing a scenario with a difficulty rating -0.046 (1 - 1.046).

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| ***P*** | ***P* in %** | **Difficulty rating** |
| 0.02 | 2% | *θ* + 3.8918 |
| 0.04 | 4% | *θ* + 3.1781 |
| 0.06 | 6% | *θ* + 2.7515 |
| 0.08 | 8% | *θ* + 2.4423 |
| 0.1 | 10% | *θ* + 2.1972 |
| 0.12 | 12% | *θ* + 1.9924 |
| 0.14 | 14% | *θ* + 1.8153 |
| 0.16 | 16% | *θ* + 1.6582 |
| 0.18 | 18% | *θ* + 1.5163 |
| 0.2 | 20% | *θ* + 1.3863 |
| 0.22 | 22% | *θ* + 1.2657 |
| 0.24 | 24% | *θ* + 1.1527 |
| 0.26 | 26% | *θ* + 1.046 |
| 0.28 | 28% | *θ* + 0.9445 |
| 0.3 | 30% | *θ* + 0.8473 |
| 0.32 | 32% | *θ* + 0.7538 |
| 0.34 | 34% | *θ* + 0.6633 |
| 0.36 | 36% | *θ* + 0.5754 |
| 0.38 | 38% | *θ* + 0.4895 |
| 0.4 | 40% | *θ* + 0.4055 |
| 0.42 | 42% | *θ* + 0.3228 |
| 0.44 | 44% | *θ* + 0.2412 |
| 0.46 | 46% | *θ* + 0.1603 |
| 0.48 | 48% | *θ* + 0.08 |
| 0.5 | 50% | *θ* + 0 |
| 0.52 | 52% | *θ* - 0.08 |
| 0.54 | 54% | *θ* - 0.1603 |
| 0.56 | 56% | *θ* - 0.2412 |
| 0.58 | 58% | *θ* - 0.3228 |
| 0.6 | 60% | *θ* - 0.4055 |
| 0.62 | 62% | *θ* - 0.4895 |
| 0.64 | 64% | *θ* - 0.5754 |
| 0.66 | 66% | *θ* - 0.6633 |
| 0.68 | 68% | *θ* - 0.7538 |
| 0.7 | 70% | *θ* - 0.8473 |
| 0.72 | 72% | *θ* - 0.9445 |
| 0.74 | 74% | *θ* - 1.046 |
| 0.76 | 76% | *θ* - 1.1527 |
| 0.78 | 78% | *θ* - 1.2657 |
| 0.8 | 80% | *θ* - 1.3863 |
| 0.82 | 82% | *θ* - 1.5163 |
| 0.84 | 84% | *θ* - 1.6582 |
| 0.86 | 86% | *θ* - 1.8153 |
| 0.88 | 88% | *θ* - 1.9924 |
| 0.9 | 90% | *θ* - 2.1972 |
| 0.92 | 92% | *θ* - 2.4423 |
| 0.94 | 94% | *θ* - 2.7515 |
| 0.96 | 96% | *θ* - 3.1781 |
| 0.98 | 98% | *θ* - 3.8918 |

# TwoA class

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| **Class** | |
| Class name | TwoA |
| Namespace | TwoA |
| Assembly | TwoA |
| Description | The main class of the asset. An instance of this class should be created to access asset’s API. |

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| **Constructor** | |
| Name | TwoA(IBridge bridge) |
| Description | Initializes a new instance of the TwoA class. |
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| **Parameter name** | **Parameter description** |
| IBridge bridge | Instance of IBridge as defined in the RAGE client-side asset architecture. |

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| **Field name** | **Field description** |
| public List<PlayerNode> players | A list of PlayerNode instances. An empty list is automatically initialized during constructor call. Each PlayerNode instance contains data of a single player. Refer to PlayerNode section for more information. |
| public List<ScenarioNode> scenarios | A list of ScenarioNode instances. An empty list is automatically initialized during constructor call. Each ScenarioNode instance contains data of a single game scenario. Refer to ScenarioNode section for more information. |
| public List<Gameplay> gameplays | A list of Gameplay instances. An empty list is automatically initialized during constructor call. Each Gameplay instance contains a single assessment record created at the end of UpdateRatings method. Refer to Gameplay section for more information. |

## Methods for adaptation.

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| **Method** | |
| Name | string TargetScenarioID(string adaptID, string gameID, string playerID) |
| Description | Returns ID of a game scenario with a difficulty rating that matches the skill rating of a specified player. The player data is retrieved from the TwoA.players list. The recommended scenario is selected from TwoA.scenarios list. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module to be used (refer to “Adaptation modules”). |
| string gameID | ID of a game from which a scenario will be selected. |
| string playerID | ID of a player to whom the scenario difficulty should be matched. |
| **Return type** | **Return description** |
| string | ID of a game scenario of recommended difficulty. Null if any error occurred. |

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| **Method** | |
| Name | string TargetScenarioID(PlayerNode playerNode) |
| Description | Returns ID of a game scenario with a difficulty rating that matches the skill rating of a specified player. The recommended scenario is selected from TwoA. scenarios list. |
| **Parameter name** | **Parameter description** |
| PlayerNode playerNode | PlayerNode of a player to whom the scenario difficulty should be matched. |
| **Return type** | **Return description** |
| string | ID of a game scenario of recommended difficulty. Null if any error occurred. |

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| **Method** | |
| Name | ScenarioNode TargetScenario(string adaptID, string gameID, string playerID) |
| Description | Returns an instance of ScenarioNode of a game scenario with a difficulty rating that matches the skill rating of a specified player. The player data is retrieved from the TwoA.players list. The recommended scenario is selected from TwoA.scenarios list. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module to be used (refer to “Adaptation modules”). |
| string gameID | ID of a game from which a scenario will be selected. |
| string playerID | ID of a player to whom the scenario difficulty should be matched. |
| **Return type** | **Return description** |
| ScenarioNode | An instance of ScenarioNode of a game scenario of recommended difficulty. Null if any error occurred. |

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| **Method** | |
| Name | ScenarioNode TargetScenario(PlayerNode playerNode) |
| Description | Returns an instance of ScenarioNode of a game scenario with a difficulty rating that matches the skill rating of a specified player. The recommended scenario is selected from TwoA.scenarios list. |
| **Parameter name** | **Parameter description** |
| PlayerNode playerNode | PlayerNode of a player to whom the scenario difficulty should be matched. |
| **Return type** | **Return description** |
| ScenarioNode | An instance of ScenarioNode of a game scenario of recommended difficulty. Null if any error occurred. |

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| **Method** | |
| Name | ScenarioNode TargetScenario(PlayerNode playerNode, List<ScenarioNode> scenarioList) |
| Description | Returns an instance of ScenarioNode of a game scenario with a difficulty rating that matches the skill rating of a specified player. Requires a custom list of scenarios from which a recommendation should be made. |
| **Parameter name** | **Parameter description** |
| PlayerNode playerNode | PlayerNode of a player to whom the scenario difficulty should be matched. |
| List<ScenarioNode> scenarioList | A list of ScenarioNode instances from which a scenario will be selected and matched to player’s skill level. |
| **Return type** | **Return description** |
| ScenarioNode | An instance of ScenarioNode of a game scenario of recommended difficulty. Null if any error occurred. |

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| **Method** | |
| Name | double TargetDifficultyRating(string adaptID, double playerRating) |
| Description | Returns a recommended difficulty rating for a specified player skill rating. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module to be used (refer to “Adaptation modules”). |
| double playerRating | Player’s skill rating. |
| **Return type** | **Return description** |
| double | Difficulty rating. |

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| **Method** | |
| Name | double TargetDifficultyRating(PlayerNode playerNode) |
| Description | Returns a recommended difficulty rating for a specified player. |
| **Parameter name** | **Parameter description** |
| PlayerNode playerNode | PlayerNode of a player to whom the scenario difficulty should be matched. |
| **Return type** | **Return description** |
| double | Difficulty rating. |

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| **Method** | |
| Name | double TargetDifficultyRating(string adaptID, string gameID, string playerID) |
| Description | Returns a recommended difficulty rating for a specified player. The player data is retrieved from the TwoA.players list. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module to be used (refer to “Adaptation modules”). |
| string gameID | ID of a game from which a scenario will be selected. |
| string playerID | ID of a player to whom the scenario difficulty should be matched. |
| **Return type** | **Return description** |
| double | Difficulty rating. |

## Methods for assessment.

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| **Method** | |
| Name | bool UpdateRatings(string adaptID, string gameID, string playerID, string scenarioID, double rt, double correctAnswer, bool updateScenarioRating, double customKfct) |
| Description | Reassesses and updates player skill rating and, optionally, scenario difficulty rating based on player’s performance in a specified scenario. The player and scenario data is retrieved from the TwoA.players and TwoA.scenarios lists respectively. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module to be used (see “Adaptation Modules”). |
| string gameID | ID of a game from which a scenario will be selected. |
| string playerID | ID of a player to assess. |
| string scenarioID | ID of a scenario in which player’s performance was measured. |
| double rt | Player’s response time measured in milliseconds (see “Adaptation Modules”). If adaptation is based on accuracy only then this parameter will be automatically ignored. Should be higher than 0. |
| double correctAnswer | Player’s accuracy (see “Adaptation Modules”). Depending on the adaptation module should be either binary (0 or 1) or a value between 0 and 1. Assessment is not performed if accuracy value does not match module’s requirements. |
| bool updateScenarioRating | If true scenario’s difficulty rating will be reassessed and updated. |
| double customKfct | A custom K factor to control the scale of changes in player’s and scenario’s ratings. Requires a positive value. A higher value results in a bigger change in the rating. If value is 0 then TwoA uses a dynamically estimated K factor. Use this parameter with care since it can drastically influence TwoA’s performance of adaptation and assessment. Consult the table in section “Rating Scale” to decide on the K factor appropriate for you. |
| **Return type** | **Return description** |
| bool | True if ratings were reassessed and updated successfully, and false otherwise. |

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| **Method** | |
| Name | bool UpdateRatings(PlayerNode playerNode, ScenarioNode scenarioNode, double rt, double correctAnswer, bool updateScenarioRating, double customKfct) |
| Description | Reassesses and updates player skill rating and, optionally, scenario difficulty rating based on player’s performance in a specified scenario. |
| **Parameter name** | **Parameter description** |
| PlayerNode playerNode | PlayerNode of a player to assess. |
| ScenarioNode scenarioNode | ScenarioNode a scenario in which player’s performance was measure. |
| double rt | Player’s response time measured in milliseconds (see “Adaptation Modules”). If adaptation is based on accuracy only then this parameter will be automatically ignored. Should be higher than 0. |
| double correctAnswer | Player’s accuracy (see “Adaptation Modules”). Depending on the adaptation module should be either binary (0 or 1) or a value between 0 and 1. Assessment is not performed if accuracy value does not match module’s requirements. |
| bool updateScenarioRating | If true scenario’s difficulty rating will be reassessed and updated. |
| double customKfct | A custom K factor to control the scale of changes in player’s and scenario’s ratings. Requires a positive value. A higher value results in a bigger change in the rating. If value is 0 then TwoA uses a dynamically estimated K factor. Use this parameter with care since it can drastically influence TwoA’s performance of adaptation and assessment. Consult the table in section “Rating Scale” to decide on the K factor appropriate for you. |
| **Return type** | **Return description** |
| bool | True if ratings were reassessed and updated successfully, and false otherwise. |

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| **Method** | |
| Name | void CreateNewRecord(string adaptID, string gameID, string playerID, string scenarioID, double rt, double accuracy, double playerRating, double scenarioRating, DateTime timestamp) |
| Description | Records results of player assessment by creating a new instance of Gameplay class. The instance is stored in TwoA.gameplays list. The player and scenario data is retrieved from the TwoA.players and TwoA.scenarios lists respectively. This method is automatically called by UpdateRatings methods. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module to be used (see “Adaptation Modules”). |
| string gameID | ID of a game from which a scenario was selected. |
| string playerID | ID of a player that was assessed. |
| string scenarioID | ID of a scenario in which player’s performance was measured. |
| double rt | Player’s response time in milliseconds (see “Adaptation Modules”). |
| double accuracy | Player’s accuracy (see “Adaptation Modules”). Depending on the adaptation module should be either binary (0 or 1) or a value between 0 and 1. |
| double playerRating | Player’s skill rating after reassessment. |
| double scenarioRating | Scenario’s difficulty rating after reassessment. |
| DateTime timestamp | Date and time of reassessment. |

## Methods for scoring.

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| **Method** | |
| Name | double CalculateScore(double correctAnswer, double responseTime, double itemMaxDuration) |
| Description | Transforms player’s accuracy and response time into a single score measured in the range (-1, 1). |
| **Parameter name** | **Parameter description** |
| double correctAnswer | Player’s accuracy that is either 0 or 1. 1 is for success, and 0 is for fails. |
| double responseTime | Player’s response time in milliseconds. |
| double itemMaxDuration | Max amount of time a player is allowed to spend to complete a game scenario. Measured in milliseconds. |
| **Return type** | **Return description** |
| double | A score between -1 and 1. |

## Methods for controlling success rate parameter.

When recommending scenarios, TwoA tries to ensure that a player can maintain an average success rate *P* of successfully completing the scenarios. For example, if *P* = 0.75 then the player is ideally expected to successfully complete 75% of all scenarios recommended by the TwoA asset. In a more realistic case, player’s actual success rate will not be exactly 75% but close to it (little bit more or little bit less). More specifically, player’s real success rate will follow a normal distribution with mean at 0.75.

The game developer can change the success rate parameters to suit needs of specific games or player audience. Four parameters are needed to set the success rate. The first two are the mean and standard deviation defining the normal distribution. There are also two hard boundaries within which player’s real success rate is expected to lie.

The default success rate is defined by a normal distribution N(M=0.75, SD=0.1) with mean at 0.75 and a standard deviation of 0.1. Hard boundaries are 0.5 and 0.99. This means there is 95% chance that player actual success rate will be between 55% (M – 2\*SD) and 95% (M + 2\*SD), but it will never drop below 50% and never go above 99%.

Similarly, a game developer can set success rate to follow a normal distribution N(M=0.5, SD=0.1) with hard boundaries at 0.25 and 0.75. This means there is 95% chance that player actual success rate will be between 30% (M – 2\*SD) and 70% (M + 2\*SD), but it will never drop below 25% and never go above 75%.

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| **Method** | |
| Name | void SetTargetDistribution(string adaptID, double mean, double sd, double lowerLimit, double upperLimit) |
| Description | Sets the parameters for the target success rate that is used to select a scenario of a recommended difficulty. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| double mean | Mean of a normal distribution. Any value between 0 and 1 (exclusive). |
| double sd | Standard deviation of a normal distribution. Any value between 0 and 1 (exclusive). |
| double lowerLimit | Lower hard boundary. Any value between 0 and 1 (inclusive). Should be less than standard distribution mean. |
| double upperLimit | Upper hard boundary. Any value between 0 and 1 (inclusive). Should be higher than standard distribution mean. |

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| **Method** | |
| Name | double[] GetTargetDistribution(string adaptID) |
| Description | Returns the four parameters defining the target success rate that is used to select a scenario of a recommended difficulty. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| **Return type** | **Return description** |
| double[] | An array of four values: distribution mean, distribution standard deviation, lower hard boundary, and upper hard boundary. |

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| **Method** | |
| Name | void SetDefaultTargetDistribution(string adaptID) |
| Description | Sets the parameters for the target success rate to its default values that is used to select a scenario of a recommended difficulty. The default values are 0.75 for distribution mean, 0.1 for standard deviation, 0.5 for lower boundary, and 1 for upper boundary. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |

## Methods for player data.

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| **Method** | |
| Name | bool AddPlayer(string adaptID, string gameID, string playerID, double rating, double playCount, double kFactor, double uncertainty, DateTime lastPlayed) |
| Description | Creates a new instance of PlayerNode and adds it to the TwoA.players list. Requires custom parameter values. Ensures that all player parameters have valid values before creating the instance. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module to be used (see “Adaptation Modules”). |
| string gameID | ID of a game to which the player instance belongs. |
| string playerID | ID of a player. This ID is not allowed to duplicate for the same combination of the gameID and adaptID already present in the TwoA.players list. |
| double rating | Player’s skill rating. |
| double playCount | The number of past gameplays that were used to assess player’s skill rating. Should be a non-0 value. |
| double kFactor | K factor. Should be higher than 0. |
| double uncertainty | Uncertainty in player’s rating. Should be a value between 0 and 1 (inclusive). |
| DateTime lastPlayed | The datetime of the last gameplay that was used to assess player’s skill rating. |
| **Return type** | **Return description** |
| bool | True if a new instance was successfully created, and False otherwise. |

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| **Method** | |
| Name | bool AddPlayer(string adaptID, string gameID, string playerID) |
| Description | Creates a new instance of PlayerNode and adds it to the TwoA.players list. Assigns default values to all player parameters. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module to be used (see “Adaptation Modules”). |
| string gameID | ID of a game to which the player instance belongs. |
| string playerID | ID of a player. This ID is not allowed to duplicate for the same combination of the gameID and adaptID already present in the TwoA.players list. |
| **Return type** | **Return description** |
| bool | True if a new instance was successfully created, and False otherwise. |

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| **Method** | |
| Name | bool AddPlayer(PlayerNode playerNode) |
| Description | Adds the instance of PlayerNode to the TwoA.players list. Ensures that all player parameters have valid values before adding the instance. |
| **Parameter name** | **Parameter description** |
| PlayerNode playerNode | PlayerNode instance with new player data. |
| **Return type** | **Return description** |
| bool | True if a new instance was successfully added, and False otherwise. |

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| **Method** | |
| Name | bool RemovePlayer(string adaptID, string gameID, string playerID) |
| Description | Removes the matching instance of PlayerNode from the TwoA.players list. The instance is matched by the ID combination. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string playerID | ID of a player. |
| **Return type** | **Return description** |
| bool | True if the instance was removed successfully, and False otherwise. |

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| **Method** | |
| Name | bool RemovePlayer(PlayerNode playerNode) |
| Description | Removes the instance of PlayerNode from the TwoA.players list. |
| **Parameter name** | **Parameter description** |
| PlayerNode playerNode | The instance to remove. |
| **Return type** | **Return description** |
| bool | True if the instance was removed successfully, and False otherwise. |

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| **Method** | |
| Name | PlayerNode Player(string adaptID, string gameID, string playerID) |
| Description | Returns the matching instance of PlayerNode from the TwoA.players list. The instance is matched by the ID combination. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string playerID | ID of a player. |
| **Return type** | **Return description** |
| PlayerNode | The matching instance. Null if no match is found or error occurred. |

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| **Method** | |
| Name | List<PlayerNode> AllPlayers(string adaptID, string gameID) |
| Description | Returns the all matching instances of PlayerNode from the TwoA.players list. The instances are matched by the ID combination. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| **Return type** | **Return description** |
| List<PlayerNode> | The list of matching instances. Null if no match is found or error occurred. |

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| **Method** | |
| Name | double PlayerRating(string adaptID, string gameID, string playerID) |
| Description | Returns the skill rating for the specified player. Throws NullReferenceException if PlayerNode instance is not found. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string playerID | ID of a player. |
| **Return type** | **Return description** |
| double | Skill rating. |

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| **Method** | |
| Name | double PlayerPlayCount(string adaptID, string gameID, string playerID) |
| Description | Returns the play count for the specified player. Throws NullReferenceException if PlayerNode instance is not found. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string playerID | ID of a player. |
| **Return type** | **Return description** |
| double | Play count. |

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| **Method** | |
| Name | double PlayerKFactor(string adaptID, string gameID, string playerID) |
| Description | Returns the K factor for the specified player. Throws NullReferenceException if PlayerNode instance is not found. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string playerID | ID of a player. |
| **Return type** | **Return description** |
| double | K factor. |

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| **Method** | |
| Name | double PlayerUncertainty(string adaptID, string gameID, string playerID) |
| Description | Returns the rating uncertainty for the specified player. Throws NullReferenceException if PlayerNode instance is not found. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string playerID | ID of a player. |
| **Return type** | **Return description** |
| double | Rating uncertainty. |

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| **Method** | |
| Name | DateTime PlayerLastPlayed(string adaptID, string gameID, string playerID) |
| Description | Returns DateTime instance indicating the last timestamp the player’s skill rating was (re)assessed. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string playerID | ID of a player. |
| **Return type** | **Return description** |
| DateTime | DateTime instance. |

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| **Method** | |
| Name | bool PlayerRating(string adaptID, string gameID, string playerID, double rating) |
| Description | Sets the skill rating for the specified player. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string playerID | ID of a player. |
| double rating | New skill rating value. |
| **Return type** | **Return description** |
| bool | True if parameter value was set successfully, and false otherwise. |

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| **Method** | |
| Name | bool PlayerPlayCount(string adaptID, string gameID, string playerID, double playCount) |
| Description | Sets the play count for the specified player. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string playerID | ID of a player. |
| double playCount | New play count. Positive Integer value. |
| **Return type** | **Return description** |
| bool | True if parameter value was set successfully, and false otherwise. |

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| **Method** | |
| Name | bool PlayerKFactor(string adaptID, string gameID, string playerID, double kFactor) |
| Description | Sets the K factor for the specified player. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string playerID | ID of a player. |
| double kFactor | New K factor. Positive non-0 value. |
| **Return type** | **Return description** |
| bool | True if parameter value was set successfully, and false otherwise. |

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| **Method** | |
| Name | bool PlayerUncertainty(string adaptID, string gameID, string playerID, double uncertainty) |
| Description | Sets the rating uncertainty for the specified player. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string playerID | ID of a player. |
| double uncertainty | New uncertainty. Value between 0 and 1 (inclusive). |
| **Return type** | **Return description** |
| bool | True if parameter value was set successfully, and false otherwise. |

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| **Method** | |
| Name | bool PlayerLastPlayed(string adaptID, string gameID, string playerID, DateTime lastPlayed) |
| Description | Sets the DateTime instance indicating the last timestamp the player’s skill rating was (re)assessed. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string playerID | ID of a player. |
| DateTime lastPlayed | Datetime of the last (re)assessment. |
| **Return type** | **Return description** |
| bool | True if parameter value was set successfully, and false otherwise. |

## Methods for scenario data.

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| **Method** | |
| Name | bool AddScenario(string adaptID, string gameID, string scenarioID, double rating, double playCount, double kFactor, double uncertainty, DateTime lastPlayed, double timeLimit) |
| Description | Creates a new instance of ScenarioNode and adds it to the TwoA.scenarios list. Requires custom parameter values. Ensures that all scenario parameters have valid values before creating the instance. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module to be used (see “Adaptation Modules”). |
| string gameID | ID of a game to which the scenario instance belongs. |
| string scenarioID | ID of a scenario. This ID is not allowed to duplicate for the same combination of the gameID and adaptID already present in the TwoA.scenarios list. |
| double rating | Scenario’s skill rating. |
| double playCount | The number of past gameplays that were used to assess scenario’s difficulty rating. Should be a non-0 value. |
| double kFactor | K factor. Should be higher than 0. |
| double uncertainty | Uncertainty in scenario’s rating. Should be a value between 0 and 1 (inclusive). |
| DateTime lastPlayed | The datetime of the last gameplay that was used to assess scenario’s difficulty rating. |
| double timeLimit | Time limit within which a player should complete the scenario. Measured in milliseconds. |
| **Return type** | **Return description** |
| bool | True if a new instance was successfully created, and False otherwise. |

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| **Method** | |
| Name | bool AddScenario(string adaptID, string gameID, string scenarioID) |
| Description | Creates a new instance of ScenarioNode and adds it to the TwoA.scenarios list. Assigns default values to all scenario parameters. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module to be used (see “Adaptation Modules”). |
| string gameID | ID of a game to which the scenario instance belongs. |
| string scenarioID | ID of a scenario. This ID is not allowed to duplicate for the same combination of the gameID and adaptID already present in the TwoA.scenarios list. |
| **Return type** | **Return description** |
| bool | True if a new instance was successfully created, and False otherwise. |

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| **Method** | |
| Name | bool AddScenario(ScenarioNode scenarioNode) |
| Description | Adds the instance of ScenarioNode to the TwoA.scenarios list. Ensures that all scenarios parameters have valid values before adding the instance. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module to be used (see “Adaptation Modules”). |
| string gameID | ID of a game to which the scenario instance belongs. |
| ScenarioNode scenarioNode | ScenarioNode instance with data for the new scenario. |
| **Return type** | **Return description** |
| bool | True if a new instance was successfully created, and False otherwise. |

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| **Method** | |
| Name | bool RemoveScenario(string adaptID, string gameID, string scenarioID) |
| Description | Removes the matching instance of ScenarioNode from the TwoA.scenarios list. The instance is matched by the ID combination. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string scenarioID | ID of a scenario. |
| **Return type** | **Return description** |
| bool | True if the instance was removed successfully, and False otherwise. |

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| **Method** | |
| Name | bool RemoveScenario(ScenarioNode scenarioNode) |
| Description | Removes the instance of ScenarioNode from the TwoA.scenarios list. |
| **Parameter name** | **Parameter description** |
| ScenarioNode scenarioNode | The instance to remove. |
| **Return type** | **Return description** |
| bool | True if the instance was removed successfully, and False otherwise. |

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| **Method** | |
| Name | ScenarioNode Scenario(string adaptID, string gameID, string scenarioID) |
| Description | Returns the matching instance of ScenarioNode from the TwoA.scenarios list. The instance is matched by the ID combination. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string scenarioID | ID of a scenario. |
| **Return type** | **Return description** |
| ScenarioNode | The matching instance. Null if no match is found or error occurred. |

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| **Method** | |
| Name | List<ScenarioNode> AllScenarios(string adaptID, string gameID) |
| Description | Returns the all matching instances of ScenarioNode from the TwoA.scenarios list. The instances are matched by the ID combination. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| **Return type** | **Return description** |
| List<ScenarioNode> | The list of matching instances. Null if no match is found or error occurred. |

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| **Method** | |
| Name | double ScenarioRating(string adaptID, string gameID, string scenarioID) |
| Description | Returns the difficulty rating for the specified scenario. Throws NullReferenceException if ScenarioNode instance is not found. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string scenarioID | ID of a scenario. |
| **Return type** | **Return description** |
| double | Difficulty rating. |

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| **Method** | |
| Name | double ScenarioPlayCount(string adaptID, string gameID, string scenarioID) |
| Description | Returns the play count for the specified scenario. Throws NullReferenceException if ScenarioNode instance is not found. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string scenarioID | ID of a scenario. |
| **Return type** | **Return description** |
| double | Play count. |

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| **Method** | |
| Name | double ScenarioKFactor(string adaptID, string gameID, string scenarioID) |
| Description | Returns the K factor for the specified scenario. Throws NullReferenceException if ScenarioNode instance is not found. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string scenarioID | ID of a scenario. |
| **Return type** | **Return description** |
| double | K factor. |

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| **Method** | |
| Name | double ScenarioUncertainty(string adaptID, string gameID, string scenarioID) |
| Description | Returns the rating uncertainty for the specified scenario. Throws NullReferenceException if ScenarioNode instance is not found. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string scenarioID | ID of a scenario. |
| **Return type** | **Return description** |
| double | Rating uncertainty. |

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| **Method** | |
| Name | DateTime ScenarioLastPlayed(string adaptID, string gameID, string scenarioID) |
| Description | Returns DateTime instance indicating the last timestamp the scenario’s difficulty rating was (re)assessed. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string scenarioID | ID of a scenario. |
| **Return type** | **Return description** |
| DateTime | DateTime instance. |

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| **Method** | |
| Name | double ScenarioTimeLimit(string adaptID, string gameID, string scenarioID) |
| Description | Returns the time limit for the specified scenario. Throws NullReferenceException if ScenarioNode instance is not found. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string scenarioID | ID of a scenario. |
| **Return type** | **Return description** |
| double | Time limit. |

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| **Method** | |
| Name | bool ScenarioRating(string adaptID, string gameID, string scenarioID, double rating) |
| Description | Sets the difficulty rating for the specified scenario. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string scenarioID | ID of a scenario. |
| double rating | New difficulty rating value. |
| **Return type** | **Return description** |
| bool | True if parameter value was set successfully, and false otherwise. |

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| **Method** | |
| Name | bool ScenarioPlayCount(string adaptID, string gameID, string scenarioID, double playCount) |
| Description | Sets the play count for the specified scenario. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string scenarioID | ID of a scenario. |
| double playCount | New play count. Positive Integer value. |
| **Return type** | **Return description** |
| bool | True if parameter value was set successfully, and false otherwise. |

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| **Method** | |
| Name | bool ScenarioKFactor(string adaptID, string gameID, string scenarioID, double kFactor) |
| Description | Sets the K factor for the specified scenario. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string scenarioID | ID of a scenario. |
| double kFactor | New K factor. Positive non-0 value. |
| **Return type** | **Return description** |
| bool | True if parameter value was set successfully, and false otherwise. |

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| **Method** | |
| Name | bool ScenarioUncertainty(string adaptID, string gameID, string scenarioID, double uncertainty) |
| Description | Sets the rating uncertainty for the specified scenario. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string scenarioID | ID of a scenario. |
| double uncertainty | New uncertainty. Value between 0 and 1 (inclusive). |
| **Return type** | **Return description** |
| bool | True if parameter value was set successfully, and false otherwise. |

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| **Method** | |
| Name | bool ScenarioLastPlayed(string adaptID, string gameID, string scenarioID, DateTime lastPlayed) |
| Description | Sets the DateTime instance indicating the last timestamp the scenario’s difficulty rating was (re)assessed. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string scenarioID | ID of a scenario. |
| DateTime lastPlayed | Datetime of the last (re)assessment. |
| **Return type** | **Return description** |
| bool | True if parameter value was set successfully, and false otherwise. |

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| **Method** | |
| Name | bool ScenarioTimeLimit(string adaptID, string gameID, string scenarioID, double timeLimit) |
| Description | Sets the time limit for the specified scenario. |
| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module (see “Adaptation Modules”). |
| string gameID | ID of a game. |
| string scenarioID | ID of a scenario. |
| double timeLimit | New time limit. Positive non-0 value. |
| **Return type** | **Return description** |
| bool | True if parameter value was set successfully, and false otherwise. |

# PlayerNode class

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| **Class** | |
| Class name | PlayerNode |
| Namespace | TwoA |
| Assembly | TwoA |
| Description | Stores adaptation and assessment data for a player. |

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| **Constructor** | |
| Name | PlayerNode(string adaptID, string gameID, string playerID, double rating, double playCount, double kFct, double uncertainty, DateTime lastPlayed) |
| Description | Initializes a new instance of the PlayerNode class with custom parameter values. |
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| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module to be used (see “Adaptation Modules”). |
| string gameID | ID of a game to which the player instance belongs. |
| string playerID | ID of a player. |
| double rating | Player’s skill rating. |
| double playCount | The number of past gameplays that were used to assess player’s skill rating. Should be a non-0 value. |
| double kFactor | K factor. Should be higher than 0. |
| double uncertainty | Uncertainty in player’s rating. Should be a value between 0 and 1 (inclusive). |
| DateTime lastPlayed | The datetime of the last gameplay that was used to assess player’s skill rating. |

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| **Constructor** | |
| Name | PlayerNode() |
| Description | Initializes a new instance of the PlayerNode class with default parameter values. Adaptation ID, game ID and player ID are not initialized. |

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| **Property name** | **Property description** |
| String AdaptationID | Gets or sets ID of an adaptation module to be used (see “Adaptation Modules”). |
| String GameID | Gets or sets ID of a game to which the player instance belongs. |
| String PlayerID | Gets or sets ID of a player. |
| Double Rating | Gets or sets player’s skill rating. |
| Double PlayCount | Gets or sets the number of past gameplays that were used to assess player’s skill rating. Should be a non-0 value. |
| Double KFactor | Gets or sets the K factor. Should be higher than 0. |
| Double Uncertainty | Gets or sets the uncertainty in player’s rating. Should be a value between 0 and 1 (inclusive). |
| DateTime LastPlayed | Gets or sets the datetime of the last gameplay that was used to assess player’s skill rating. |

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| **Method** | |
| Name | PlayerNode ShallowClone() |
| Description | Creates and returns a shallow clone of the instance. |
| **Return type** | **Return description** |
| PlayerNode | New instance of PlayerNode. |

# ScenarioNode class

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| **Class** | |
| Class name | ScenarioNode |
| Namespace | TwoA |
| Assembly | TwoA |
| Description | Stores adaptation and assessment data for a scenario. |

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| **Constructor** | |
| Name | ScenarioNode(string adaptID, string gameID, string scenarioID, double rating, double playCount, double kFct, double uncertainty, DateTime lastPlayed, double timeLimit) |
| Description | Initializes a new instance of the ScenarioNode class with custom parameter values. |
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| **Parameter name** | **Parameter description** |
| string adaptID | ID of an adaptation module to be used (see “Adaptation Modules”). |
| string gameID | ID of a game to which the scenario instance belongs. |
| string scenarioID | ID of a scenario. |
| double rating | Scenario’s difficulty rating. |
| double playCount | The number of past gameplays that were used to assess scenario’s difficulty rating. Should be a non-0 value. |
| double kFactor | K factor. Should be higher than 0. |
| double uncertainty | Uncertainty in scenario’s rating. Should be a value between 0 and 1 (inclusive). |
| DateTime lastPlayed | The datetime of the last gameplay that was used to assess scenario’s difficulty rating. |
| double timeLimit | Time limit within which a player should complete the scenario. Measured in milliseconds. |

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| **Constructor** | |
| Name | ScenarioNode() |
| Description | Initializes a new instance of the ScenarioNode class with default parameter values. Adaptation ID, game ID and scenario ID are not initialized. |

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| **Property name** | **Property description** |
| String AdaptationID | Gets or sets ID of an adaptation module to be used (see “Adaptation Modules”). |
| String GameID | Gets or sets ID of a game to which the player instance belongs. |
| String ScenarioID | Gets or sets ID of a scenario. |
| Double Rating | Gets or sets scenario’s difficulty rating. |
| Double PlayCount | Gets or sets the number of past gameplays that were used to assess scenario’s difficulty rating. Should be a non-0 value. |
| Double KFactor | Gets or sets the K factor. Should be higher than 0. |
| Double Uncertainty | Gets or sets the uncertainty in scenario’s rating. Should be a value between 0 and 1 (inclusive). |
| DateTime LastPlayed | Gets or sets the datetime of the last gameplay that was used to assess scenario’s difficulty rating. |
| Double TimeLimit | Gets or sets the time limit within which a player should complete the scenario. Measured in milliseconds. |

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| **Method** | |
| Name | ScenarioNode ShallowClone() |
| Description | Creates and returns a shallow clone of the instance. |
| **Return type** | **Return description** |
| ScenarioNode | New instance of ScenarioNode. |

# Gameplay class

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| **Class** | |
| Class name | Gameplay |
| Namespace | TwoA |
| Assembly | TwoA |
| Description | Stores results of a player assessment. An instance of this class is stored in TwoA.gameplays list. |

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| **Constructor** | |
| Name | Gameplay() |
| Description | Initializes a new instance of the Gameplay class. |

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| **Property name** | **Property description** |
| String AdaptationID | Gets or sets ID of an adaptation module to be used (see “Adaptation Modules”). |
| String GameID | Gets or sets ID of a game to which the player instance belongs. |
| String PlayerID | Gets or sets ID of a player that was assessed. |
| String ScenarioID | Gets or sets ID of a scenario in which player’s performance was measured. |
| String Timestamp | Gets or sets the datetime of assessment. |
| Double RT | Gets or sets the player’s response time. Measured in milliseconds. |
| Double Accuracy | Gets or sets the player’s accuracy. |
| Double PlayerRating | Gets or sets the player’s skill rating after assessment. |
| Double ScenarioRating | Gets or sets the scenario’s difficulty rating after assessment. |