Shadowmatch®

Research & Validation Manual

An Overview of the Shadowmatch Behavioral Benchmarking System and Associated Research

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1. Introduction

One of the most interesting questions about humans is the fact that we still know so little about ourselves. Arguably, scholars and academics do know a lot, but actually they really only understand how little we know! On the other hand, despite this humble note from the majority of well-learned academics, we do know a lot. The science of studying human behavior has grown enormously. Human behavior has become one of the most interesting subjects to research. With so many fields of specialization, the young scholar may find it very difficult to choose between all the areas of behavioral research. Human behavior is both interesting and complex. Despite all these challenges, people are actually very similar, easy to understand and predictable. We live with each other every day, we understand one another, and we (sometimes) get along very well. This then defines the subject of human behavior: simple on the one hand, and very complex on the other.

One of the challenges in modern psychology and other sciences studying human behavior resides in the fact that there are multiple definitions defining single human behaviors and conditions. A very simple example is our efforts to define the so-called 'Normal Person'.

A more intriguing question is whether it is possible to know exactly how people think and what they think. What is their awareness content when they work, or when they play, read, laugh, etc.? The world of knowledge concerning these questions is so vast that even highly trained people sometimes find it difficult to find their way through all the knowledge faculties, information theories and hypothesis'. The question is very immanent: Can we simplify this mountain of information? In a way, we can and we cannot. To get a full understanding of the functional working of the human mind will remain an extremely complex field of scientific work, research and comprehension. The research team who worked on the development on Shadowmatch was/is obsessed with simplifying the way we look at people, how they behave and whether their successes can be enhanced and predicted in a positive and credible way. With this, we do not intend to reduce the complexity of the human mind but to create a framework that provides a meaningful content about an individual.

Shadowmatch originated from academia and was developed as a result of the following question: Why do some top students from school fail at university and why do some succeed? All the students left school with equal results; they proceeded to the same university studying in certain groups the same degrees. Some of these top students were very successful, some failed miserably and some eventually completed their degrees with sweat and tears. The research and case study research was conducted in other areas where success in the working environment could be monitored. The research delivered some staggering results. The same principles identified amongst successful and less successful students were applicable across almost all situations where people need to perform a task successfully.

It is critical, not only for the individual but also for the institution or employer to determine whether someone will succeed in performing a task or not. It is important for the individual as failure can have long lasting negative effects on the person and it has serious implications for the employer and/or the university where the individual failed. In order to prevent this negative spiral, it is imperative to pre-determine if someone will succeed in a specific job in a specific environment. It must also be noted that once an individual is successful, he/she experiences a level of fulfillment and happiness that creates positive energy influencing the entire working

environment around that individual. In addition to this, the value of a successful workforce is critical to the overall success of organizations.

Predicting the Success of People and Pre-identifying Successful People

Top performing people can provide as much as ten times more value to a company compared to poor performing people and as much as seven times more than average performing people. These top performers are the key drivers towards successful business. On a strategic business development level, a highly talented individual can determine the destiny of an entire company. Successful business depends on top performing people on all levels of its operational functions. The problem being that this challenge is not always fully understood and the way in which employers approach the imperative of finding successful people normally does not provide against the need of most companies.

We first need to define a successful person. This is someone who performs a task in such a way that the outcome matches the expectation and regularly exceeds the expectation. A top performer is someone who continuously and even radically exceeds the expectation normally met by successful people.

It seems evident that the majority of people can be successful and a higher than expected percentage of people can be top performers. The challenge is not so much finding them. The challenge is the fact that the person does not only determine success. Success is somewhat more complex. Success in the workplace only materializes when the task at hand, the capabilities and preferences of the individual as well as the working environment match in such a way that the persons' talents, skills and potential can flourish. There are three realities that must be in alignment in order for an individual to be successful and to possibly become a top performer:

1) The task or work that needs to be done

2) The context where the work is being done

3) The make-up, skills, qualifications and behavioral preferences of the individual

If these realities are not in harmony, even the most talented, skilled and capable person will not succeed. It is all a matter of matching the right people to the environment and the task. Although this might sound very simple to understand, it is very difficult to do. The following example will explain:

> A specific sales person outperformed all sales staff nationally on car sales. At one point in her career, she was 'headhunted' by a competitor and accepted a very lucrative compensation package. However, she failed to the extent that she voluntarily resigned to prevent a scenario of being let go for not achieving her sales quota. Her previous employer heard about this and phoned her. She went back to her previous dealer and sold the most vehicles nationally as a single sales person for nine consecutive months from the date of re-employment. During extensive interviews, she could never tell what the problem was. The fact is that the new role did not work for her. This was the problem: for some reason the context was not conducive to

her way of working. She did not like the 'set-up' at the other dealer. During an interview, she said that the ways of work was "uncomfortable for her".

It must be understood that finding top performing people is fully reliant on matching people, expectations, tasks and the working environment towards a positive performance outcome.

A closer look at this challenge is necessary. A properly qualified person is required to perform a specific job/task. Qualifications are defined as experience and/or official academic qualifications enabling an individual to be successful in doing a specific job. Top performing people must be qualified to do the job. When an employee is recruited for a job, the necessary qualifications must be very clearly defined. The question to be answered is: What qualifications must the employee have that will theoretically ensure success in doing the job? A company might for example recruit a psychologist to counsel employees traumatized as a result of the work they do. Theoretically, any qualified psychologist will easily be able to do this.

But, let's say there are further realities applicable to this position. The company provides security services to business executives in Iraq. Their security agents are being shot at every day, they are constantly under attack, many die and many are seriously injured. The workplace is in the open where the psychologist will be rushed either to the scene of the incident or the hospital. This unique workplace redefines the situation. Not every psychologist will find it easy to do the job. We need to look at additional capabilities. The only reliable way to determine what these additional capabilities are is to find psychologists that enjoy doing this in Iraq. They must also be successful in doing this work for at least a year and, they still want to do it. Their behavioral skills, habits and attitudes should have some level of congruency. They might for instance all be very altruistic, show an attitude of non-aggressive involvement in the world around them, display extreme resilience and be predominantly team players with low levels of fear (as an example). If we want to recruit somebody for this job, it will be wise to recruit someone with the same behavioral strengths. The reason is obvious. The working conditions, task and expectations are all included in the behavioral habits and strengths of those who are already successful in that environment doing that specific job. In doing this properly, the propensity to be successful in placing/deploying people have shown to be much higher than any other method known to us.

Conclusion

Successful people are those who function with a high level of harmony between their qualifications, behavioral preferences, the job, and the working environment or working conditions. People can, according to our research only become top performers if the following are in harmony:

- Person (qualifications and behavioral habits)
- The task (work/job to be done)
- The context (working conditions)

2. Research & Findings

Background

The development team working on Shadowmatch was extremely frustrated with the fact that attempts to understand the way people think did not provide any stable results. Although validity and reliability of questionnaire results were acceptable, they were only acceptable because the anticipated outcomes from the test groups were interpreted against static 'this-means-that' type of insights in how the research team thought people were thinking. Therefore, the team could still not answer the question: why do some top students from school fail at university and why do some succeed? This question is equally valid in any working environment: why do some very competent people fail in performing a certain task for which they are qualified?

As indicated above, the context where the task/job will to be done is critical. The question is what are the building blocks that constitute the context? The following aspects were identified as those creating the context/ working environment:

- Physical Environment: This refers to all tangible aspects that define the job workplace. It includes all physical realities such as getting to the workplace (workplace location), light, indoor and outdoor realities, physical danger, health impact, technology, color, temperature, sound, the tempo of activities, the need to travel, etc.

- Social Environment: Who are the people in the environment? Not only those with whom the individual will interact, but all people present in the immediate and broader environment. Every aspect of their behavior, identity, competencies, personality, qualifications, etc. contributes to the social context. This is sometimes referred to as the 'culture' of a business. This might lead to misunderstanding, as culture is not easily defined. The social environment alternatively is simply the network of people in and around a specific workplace.

- Emotional Environment: Some workplaces are emotionally very intense while others are not. Working in the trauma unit of a hospital might be emotionally very challenging for some people but not for others. The question is what the emotional content of the environment entails for every individual. There is no generic content. It might be that a specific workplace creates high levels of fear to the one individual whilst the same workplace energizes the next person to experience adventure. The fact is that some workplaces are experienced as emotionally sensitive to some people.

- Operational Environment: What is the task and what are the methods and support structures available to execute the task successfully? Working in an underground mine with all the latest technology and operational infrastructure can be very different to working on the same type of mine with old outdated machinery and operational infrastructure. Some individuals will cope with the latter and some will not.

These factors are all active in constituting a working environment where some people will thrive, some will survive and some will find it extremely counterproductive to their ways of working. For people to be successful, their behavioral preferences (habits) should be such that they can work with a high level of freedom, spending minimum energy on issues not directly related to the success of the job they have to do. This will leave them with the freedom to act within their comfortable ways and thus succeed in what they do.

What Motivates behavior?

The purpose of this manual is to provide the reader with a comprehensive introduction into the working of Shadowmatch and the thinking and reasoning behind the system. In order to understand the essence of Shadowmatch, an abbreviated introduction is necessary into the motivating factors behind human behavior.

First, it is necessary to share a critical insight from the work and research performed. The work was predominantly performed in a multiple culture context. Early during the process, it became clear that some people have very limited insight into their own psychology, their motives and even their own feelings and preferences. Some culture groups are not sensitive to critical self- insight because they were not exposed to this type of critical self-insight during their development and it is not part of their cultural setting. This limited insight can also be linked to families and sub groupings within a specific culture group.

> *Extreme caution must be applied when a test is conducted that depends on the individual to answer questions that requires advanced levels of self-knowledge and the typical psychological frames of underlying behavioral motives.*

If measuring and mapping the way people think does not provide reliable indicators, then what does? It is imperative to acknowledge that people act, do things, and behave in certain ways. These actions form a level of consistency or patterns. The things they do make them succeed or fail. These actions are the results of specific thinking patterns but the same behavior can result from different ways of thinking as well as relatively similar thinking. Different psychological content can result in the same behavior. The following example will clarify:

> Two very successful students were extensively interviewed. They both indicated that their success was the result of relentless hours with their books and a 100% lecturing attendance with full attention to the lecturing content. In short, this was their behavior towards academic success. The one student said that the energy driving his success was a level of revenge against his father who said, “He only wants to study for the fun of the experience and does not have the ability to succeed as a student”. The other student was very clear. He comes from a relatively poor family and he was obsessed to break the curse of poverty his family suffered. This describes the essence of the challenge. The psychological content was radically different whilst the behavioral patterns were very much the same. It is therefore imperative to map the behavior of people in order to identify <u>what</u> they do that makes them successful. The reason <u>why</u> they do what they do is not important to determine whether they were successful or not.

In an effort to answer the question of 'what motivates people to behave in a specific way', the following example motivators can be identified:

> Caring, revenge, survival, biological needs, ego, fulfillment, obsessions, greed, fear, enjoyment, discomfort, sense for responsibility, group behavior, approval, context/situation, upbringing, a decision made by the individual and habits.

When we want to understand exactly what motivates a specific action, the challenge to untangle the motivators becomes impossible. The reason for this level of difficulty is the fact that more than one of these motivators can motivate behavior, as well as the fact that there are motivators within motivators. The majority of people do not know why they behave in a certain way. It becomes a very complex riddle to resolve the psychological motivational complexities behind our actions; it is a long and complex process exclusive to only the most highly qualified people.

On the other hand, behavior is very clear. We can see what people do, we can measure what they do, and we can count and quantify the intensity of their behavior. Let us (for a moment) forget about the motivators and psychological complexities behind our behavior. Why did the one student succeed and the other fail? The one answered the questions correctly and the other one did not. In a work and performance environment, we need to be very pragmatic. Will the actions of the person lead to success or failure? Will someone be able to consistently, and sustainably do the things necessary to be successful at a specific job in a specific environment? The only way to determine this is by means of finding a pattern of behavior (or 'Benchmark Habits') necessary for success (in a task that is context specific) and to compare the habits of an individual to these Benchmark Habits. This is what Shadowmatch does.

To understand the broad functionality of Shadowmatch it is imperative to understand some background on human behavior with specific emphasis on habits as an important driver of human behavior.

Understanding Habits

One of the most reliable ways to predict the behavior of people is to determine what habits the individual lives by. Habits are very reliable: they have recurrence patterns that are predictable with a high degree of accuracy. What is a habit? A habit is an action that repeats itself with no (or minimal) conscious planning. It repeats itself when the situation is conducive to such behavior and the person has a goal of fulfilling his/her need in some way by doing what they normally do. This action can then become a habit.

Any behavioral pattern can become a habit. When is behavior a habit? What else do we need to know about habits?

- Any behavior that repeats with minimal/no planning can be a habit
- Habits are learnt behavior
- Habits are formed through repetition
- Habits are very predictable
- Any behavior can become a habit (getting up early, solving problems, working alone, disengaging when frustrated, etc.)
- Habits are extremely difficult to break
- When an individual cannot freely live by his/her habits, he/she finds it extremely difficult to function properly
- People living their lives along well-established habits show highly predictable behavior. The opposite is also true
- All habits are not equally well established
- Habits can transcend contextual boundaries (a habit developed in one context can manifest in another context without a clear link to the environment where the habit has been developed)
- Habits always attach to some kind of meaningful goal/purpose for the individual. This purpose might be something like avoiding discomfort, being successful, being efficient etc.
- Habits can form pairs or tandem habits. This happens when two or more related behavioral types are well developed (e.g. 'people-positive' behavior and 'altruism'. When these habits are both strong, they contribute to each other and each behavior becomes even more prominent

If a process could be found to successfully map the habits of people and how well established they are, would it answer the question 'Why are some well qualified people successful and why do some fail?' It did not! The reason is obvious: what do you compare the map of habits to, and how do you know what the fit will be between the behaviors of the individual and those in the environment where he/she is expected to be successful? Further to this question is the challenge to determine what habits will be necessary to successfully perform the task towards the desired result. A way must be found that will include a match between the habits of people, the task at hand and the specific workplace. No reliable way could be found to measure these factors in combination. Many hours were wasted by experienced and qualified people in an effort to define the behavioral patterns necessary to succeed in doing a specific job at a specific work place. On the other hand, people rarely know what makes them successful. Any effort to map the critical behavior that leads to success at performing a specific task either became intelligent guessing or a very complicated task only possible to be done by highly qualified specialists over a relative long period of time. To map the environment and behavior that will be successful in a specific working context is even more challenging if not completely impossible.

The research turned in a different direction. By identifying a small group of successful students doing a specific course at a specific institution, it is easy to understand that their behavior is the right behavior for the task and it is suitable for the context. It might not be the only successful behavior, but it is successful for the environment. Once a group of successful peoples habits could be identified (students, workers, sports professionals, leaders, etc.) and critical habits could be isolated, the habit profile of the top performing group might prove to be the most preferred behavior towards success in that specific environment performing the specific task. That might just be the only credible benchmark to compare people to in order to determine their propensity to succeed (task and context specific).

Ten top performing students were then identified who were studying a specific degree at a specific university. The shared habits between these top students were identified through a process of congruency mapping of their behavior.

Critical shared patterns of behavior were identified, and habits of randomly selected individual students were then compared to the shared habits of the successful group. A very high level of congruency emerged from this process. When the habits of students that failed were compared to the shared habits of the successful students doing the same course at the same institution it became clear that the students who failed, lacked the habits of the successful group. Successful students always shared the strong habits of the benchmark group.

Because this was a breakthrough towards successfully anticipating the propensity of people to succeed in performing a specific task in a specific environment, the research program was extended to different areas of work: sales people, administrative staff, customer service agents, engineers etc. The results were consistently the same. The only critical inflection points were the following:

- The benchmark group must be selected with extreme caution: there is no such thing as a generic benchmark profile. It does not work! (See selection criteria below)
- A map of habits must be created: it is what people do that determines their success not why they do it
- The benchmark profile is not fixed: it changes and therefore it has to be redone at least once a year

Criteria for Selecting Top Performers

- They must be working in the operation and current position for a period of more than 8 months
- They must consistently be amongst the top performers in the operation on all levels of the work they do (quality of work, quantity delivered, task efficiency in doing the job)
- They must have a positive influence on the team they work with and play a motivating role in the group (all people they work with must experience them as positive and enthusiastic towards their environment and the work they do)
- They must be the most skilled and knowledgeable workers in the operation

Shadowmatch has been developed as a computer based system to do the following:

> **To find the best match between the behavioral habits of an individual, the environment where the task is performed, and the task/job to be done**

Shadowmatch draws a map of behavioral habits by means of a worksheet that the individual needs to complete by answering a series of questions. The questions place the individual in normal day-to-day situations. The individual then selects an answer that best describes the way he/she behaves in each situation. The selected answers are processed by a fuzzy logic calculator designed to identify behavior patterns. The identified behavior patterns (habits) are weighed against recurrence patterns, as well as the relative strength of the behavioral indicator. All these calculations identify habits in the behavior of the individual as well as how well these habits are formed and matured in the way the specific individual lives his/her life. The results are displayed as a graph indicating which habits are well established and which are not.

Statistically (and through thousands of individual studies) it became clear that when a person has gathered less than 30 points in a specific behavioral type, that type of behavior cannot be described as a habit. In other words, the individual will not act with minimal or no planning when doing this.

> A good example is the habit of 'problem solving'. When this is a well embedded habit, the individual will find it easy to solve problems, he/she will enjoy it, do it with purpose and solve problems when they appear with minimal/no conscious decision-making on whether the problem needs to be solved or not. When this behavior is not a well-embedded habit, the individual will (when there is a problem to be solved) have to consciously decide and plan on what he/she will do: solve the problem or just leave it.

When the individual scored between 30 and 50 points, the specific behavioral type is a relatively well-formed habit. It functions somewhat selective but it is present as a habit.

If the score is between 50 and 70 points the behavior is well embedded as a habit and the individual will find it easy to act in such a way that this habit becomes an active way of normal life.

When the score exceeds 70 points, the specific behavioral type is a strong habit, it will function across different situations, it will be easy for the individual to act accordingly and the specific behavior will be highly consistent and predictable.

Habits Identified

- **Propensity to own & Propensity to Hand-Off**: These two habits indicate whether the individual takes ownership to solve a problem and handles a challenge him/herself, or whether he/she prefers an outside agent to solve problems, handle difficulties or even execute tasks. It refers to the place where the individual places the control and/or task execution, with him/herself or outside of him/herself. In some jobs, a habit of handing-off a task is necessary, in some jobs it is not. The same applies to keeping the task as a self-execution responsibility. From the data gathered by Shadowmatch, it is clear that for some unique tasks a balance between the two is necessary.

- **To Simplify**: refers to the habit of breaking complex scenarios down to linear challenges that can easily be resolved. It can be seen as the habit of taking the easy route towards solving complex challenges. This habit normally relates to efficiency where an individual has developed the ability to find the simple way to resolve challenges/problems. The habit of simplification can develop in tandem with the habit of problem solving. When both these habits are well formed the individual might develop extremely strong behaviors towards effectively solving problems by applying extremely simple ways towards a solution.

- **Resilience**: Some people give up easily when faced with a challenge and some apply themselves relentlessly to solve problems and overcome challenges. The Shadowmatch worksheet calculates the habit of the person in overcoming challenges despite the difficulties experienced. It also calculates whether the individual tends to give up or whether he/she completes a task despite difficulties and toughness of the journey. Be aware of the fact that if the individual answers the questions in a specific way, it might indicate a negative level of resilience. When this happens, the indication is that the specific person tends to disembark from a task not because he/she experienced the task to be tough but because he/she anticipates it to be tough without even trying. If this is a habit (giving up without even trying) the individual will also tend to develop a habit of low self-confidence.

- **Propensity to Change**: Some people find it very difficult to adapt to change and to get comfortable with new methods, new ways of doing things, new environments and new technology. On the other hand there are people who advocate change, they always venture towards new frontiers. These people are very comfortable with anything new, be it a new job, new ways of doing things, new technology and so on. Shadowmatch determines how positive (comfortable) the individual behaves towards change and adopts anything new, different and even strange. If this is marked as a habit, (more than 50 points) it indicates the behavioral pattern of pushing for change, embracing the 'new', and even inviting those around them to participate in a process of changing the world where they work and live.

- **Propensity to Handle Frustration**: This Shadowmatch calculator indicates an individual's habit towards applying positive behavior when dealing with frustrating circumstances. Frustration occurs when the individual is obstructed from reaching his/her goal. It is the experience that stems from a situation when obstacles block one from reaching a goal. A high graph indicates a strong habit of handling a frustrating situation. The behavior types that Shadowmatch measures are those acts whereby the individual deals with the obstructing source/interference in such a way that his/her actions towards successful results, stay on track.

- **Team/Individual Inclination**: The system calculates, according to the answers given, whether the individual prefers working as part of a team or whether he/she prefers working as an individual. When these two calculations are very close to each other, it indicates that the individual is equally comfortable working in a team or as an individual.

- **Self-Motivation**: Some people have the habit of energizing themselves whilst others are dependent on external energizers to stay positive, driven and active. Shadowmatch calculates the individual's habit towards the capacity of the individual to behave with high levels of energy despite the absence of external motivating agents. Self-Motivation is the behavior of continuous positive action towards a desired outcome in the absence of external energizers.

- **Routine**: The routine graph is an indicator of an individual's habit towards structure and repetition, sometimes even mundane activities. It determines whether the individual has a habit of behaving in harmony with an environment of repetition and patterns of the same behavior. A high graph indicates a high propensity towards a positive blend between the individual and an environment where structure and routine results in a reality whereby every day is pretty much the same as the previous.

- **Problem Solving**: This is the habit of engaging with challenges on a conceptual, social and practical level and successfully managing these difficulties/challenges towards resolving them. People with a strong embedded habit of problem solving become easily intrigued by challenges and riddles to be resolved. In fact, if anybody scores more than 70 points on problem solving, they will find it extremely difficult not to engage with a challenge to be resolved. When an individual scores less than 30 points he/she will find it easy to bypass or even ignore a problem that needs some effort to be resolved.

- **Responsiveness**: This indicates the individual's reaction speed, in other words the habit of acting immediately if and when necessary. A low graph will merely indicate that an individual does not have the habit of acting immediately, whilst a high graph indicates the habit of acting immediately. As with all Shadowmatch indicators, there is no good or bad in this calculation. In some jobs, people do not need to act quickly, they need to wait and think very thoroughly. In some jobs, people must act quickly. This indicates the individual's inclination. A high score indicates a strong habit of responsiveness.

- **Innovation**: This is the habit of finding new ways and identifying better processes and methods to improve on current methods of working. It also indicates the habit of working out-of-the-box and creating new realities. Shadowmatch defines innovation as the behavior of an individual doing things that are new, designing new practical functionalities that improve on the way things are done and even creating new realities. Someone with great ideas is not regarded as innovative. Shadowmatch regards them as dreamers – something Shadowmatch prefers not to map or pretend to understand.

- **People Positive Behavior**: This calculates whether the individual has the habit of working with people in a positive way and building positive relationships. It also tracks the way a person influences people towards a positive and meaningful experience of life. The system follows answers that will indicate a natural people oriented person, somebody not easily frustrated by others.

- **Discipline**: This is the habit of working under extreme levels of discipline in a highly disciplined working environment where adherence to structure, rules and regulations and periods are imperative. People with a high (above 70) score on this habit will even create structures of discipline for others to adhere to. Individuals with an extremely low score do not easily conform to structure, discipline and strict order.

- **Conceptual Capabilities**: The conceptual questions measure an individual's application of his/her abstract ability. In other words: To what level has the individual developed the habit to apply his/her mind in working through an abstract problem towards finding the correct solution? This does not indicate if a person is conceptually strong or weak, it indicates whether the person continuously applies his/her mind towards solving a problem with an expected successful result.

- **Conflict Handling**: Conflict manifests in a situation where people have opposing interests that might unfold with destructive consequences to each other. This reading on the Shadowmatch graph indicates the habit of dealing with conflict in a positive way towards and outcome with no or minimal negative consequences for either party. Avoiding conflict is not regarded by this worksheet as a positive way to deal with it.

- **Altruism**: This reflects a person's willingness to help others without expecting something back. People that have a strong altruistic habit are relatively free from the "what's in it for me?" approach to helping others. These people do well in service driven jobs. Shadowmatch has gathered evidence to the effect that a high score on altruistic behavior does not always implicate a high score on people positive behavior.

- **Self Confidence**: Shadowmatch calculates behavior that indicates the person's ability to act with conviction and stay with a decision that he/she has made. In short, self-confidence is the habit of acting with a high level of trust in your own abilities, qualities and judgment, knowing who you are and what you can and cannot do. A high score indicates that an individual has a habit of acting in a secure and confident manner.

- **Task Efficiency**: When someone completes the Shadowmatch worksheet, it represents an end-to-end task during which every individual tends to present a level of efficiency. These efficiencies are being presented as recurring patterns or habits. This is a combination of how they manage their time, how efficient they are in doing the job end to end and how successfully they are in getting the job done correctly. The Task Efficiency graph calculates the relative efficiency with which the individual has completed the task of working through the Shadowmatch Worksheet. It combines total time, conceptual results and time used for the conceptual questions into a single percentage of relative efficiency. The full meaning of this calculation is a cold factual calculation of how the individual has taken ownership of completing the Shadowmatch worksheet task successfully and effectively.

- **Leadership**: Shadowmatch defines leadership as the ability to integrate resilience, discipline, a team oriented approach, the propensity to act immediately and self-confidence with an attitude of positive involvement. All these behavioral strengths are harnessed to lead a group of people towards a successful outcome.

- **Attitude**: This is the way people approach life and work through their actions. It must not be seen as body language. Attitude in the framework of the Shadowmatch worksheet results indicate those actions with which someone approaches the world around them. Shadowmatch distinguishes four attitude categories:

    - Category 1 is a positive, non-aggressively involved person
    - Category 2 is a more aggressive but positively involved person
    - Category 3 is also aggressive but not always positive and not always involved
    - Category 4 is a person who is not involved, not aggressive but also not destructive

- Nobody is ever seen as a category one, two, three or four only; we are all a combination of the four with dominance in one or more of the categories. A full understanding of the different attitude categories is very important. Shadowmatch displays attitude in a separate graph. A broader description of this is necessary.

Attitude

Attitude Categories 1 and 2 share the habit of involvement. Categories 2 and 3 share the habit of assertiveness, sometimes even aggressive behavior. Categories 3 and 4 share the habit of less or even lack of involvement in the world around them. Categories 1 and 4 share the habit of unaggressive behavior.

- Attitude Category 1: Unaggressive/Involved

    These people are positively involved in the world around them. To participate and to get involved is easy for them, they do it without effort and it is embedded in their normal behavior patterns. Strong Category 1 people have a habit of participation, they engage actively and in an unaggressive way. They are positive towards people and tend to work with the bright side of life. They have strong principles in life and tend to hold on to what they see as the right things to do. They are motivated by an inner drive to make the world a better place for everybody and a willingness to contribute substantially towards this priority. They are friendly but firm, positive and progressive. They attend to the bigger things in life, and the majority of them lack attention to detail and petty issues. They are unconditional in what they do with a willingness to give up everything to fulfill their dreams. They tend not to be materialistic but they demonstrate a strong emphasis on the value of all life. The majority of Category 1 people tend work and participate without emphasis on serving other people but to drive a principle. An example will

elaborate. If a Category 1 person becomes involved in the activities of a school, they will focus on doing it for the community, the children and the future of all. They will not do it to satisfy the headmaster. They tend not to serve people as individuals but the outcome as it fits into their understanding of a principle they want to live by.

As customers and employees, they are very easy to work with. They know what they want, they are not aggressive and they honestly seek a solution to challenges. They will never shout, scream and over-react. If they escalate a problem to the next level of authority in order to be resolved, it will always be with the full knowledge and participation with those on the first level of involvement. They do not seek revenge, nor do they want to be seen and experienced as powerful and winning as they do not have the need to gain personal points. They participate more to build than to win.

- Attitude Category 2: Aggressively Involved

  These people are actively involved in everything around them. They tend to be assertive (sometimes aggressive), willing to stand (fight) for what they want and how they prefer things to happen. They have personal gain as a strong driver of their participation. They do things more with the expectation to gain some form of personal benefit in order to further their own interests. Category 2 people are normally very successful in terms of business, financial independence and position of power. Strong Category 2 people are fighters and they tend to win the fights. Sometimes, when they are convinced that things can collapse (Projects, a business or any important outcome they want to fulfill. They can become very difficult, as they are willing to take things further and put others under enormous pressure to perform. They get things done. They take people to task. They want facts and they will follow up on any threat they make. They want things their way and they are extremely strong in getting what they want. These people can become somewhat obsessed with being in control, they are very demanding, and they do not stand back. When working with strong Category 2 people, keep in mind that they are somewhat obsessed with winning and they see every situation where a problem emerges as a win-lose scenario. They want facts, answers and solutions. They tend to always put people working with them under pressure to perform. They are hardworking, dedicated and strong towards getting the job done. They participate more to win than to build. For them to build is the result of winning.

- Attitude Category 3: Aggressively Uninvolved

  Although individuals in this category have an assertive/aggressive approach towards their world, they are very different from the Category 2 group. This difference lies with the fact that Category 3 people are not involved and they do not easily become involved. The result of this attitude is that they are not dangerous and they are not on top of every situation they are faced with. They tend to be quick tempered, easy to become upset and very quick to react. There is a tendency with them to over-react and to pre-react. In other words, they will react aggressively to an incident without hearing the full story or looking at the full picture. Sometimes it might leave the impression that they are more driven by fear than by personal strength. They also tend to threaten, voice their feelings when frustrated but they seldom do anything tangible about the problem. They tend to be permanently frustrated, over critical and irritable. In the extreme, they can become abusive and personal in their attacks. Despite this behavior, they lack the energy to actively participate towards a solution. Working with strong Category 3 people can become very challenging as they are not easily satisfied. They can be over critical whilst they prefer not to get involved in order to resolve or repair the cause of their dissatisfaction.

- Attitude Category 4: Unaggressive/Uninvolved

  Category 4 people do not easily get involved in the inner working of the world where they live and work. They keep their knowledge levels with regards to the day to day activities in life down to a working minimum. They tend to only learn the basics necessary to do what needs to be done. A good example can be found in the way they might use modern technology. They will know what to do in order to get the technology to do what they need and for the rest they will prefer to stay uninformed. (E.g. Use their cellular phones to make and to take calls only). They are quiet, not demanding, happy with the basics in life, not willing to fight and very unaware of many things around them. They do not attend to detail and small issues. If something does not work for them they will either go without it, get someone to fix it or get rid of it. They might even pack it away and forget about it. They are not driven by personal obsessions. They cannot deal with conflict, don't like too much attention and they can easily switch off from something if it doesn't work for them.

  These people tend to work with the basics in life. Some of them are highly specialized people in one area of their business or in life in general, but for the rest, they just do not have the interest to get into the detail. In short, they are extremely 'selectively' switched on and unaggressive.

  Working with them is very easy if their attitude is suitable for the task and the environment. They do not get frustrated easily nor do they become I-rate. They just want things to work, they don't always want to understand how it works.

Forming, Reforming and Changing Habits

When habits are established over long periods (more than one year), the majority of people find them very difficult to change. In fact, some research has indicated that fewer than three in two hundred people are able to break a well-formed habit by merely making a decision to this effect. All habits are not equally strong and well formed in the behavior of an individual. Examples tend to explain this best. If somebody has developed the habit of helping people in need and he/she practices this habit every day over a period of say three years, it will be very difficult for this person to walk away from someone in need. How often do we hear someone say, "I just couldn't do it?" This is exactly how they experience any effort to behave against a well-developed habit. They find it impossible to break away from this behavior. Sometimes there is an opinion amongst people (despite the fact that some of them are well qualified in understanding the psychology and behavior of people) that behavior can change because of an instruction, a discussion or a decision. This is possible, but extremely rare. Change in the way people behave is (for the majority of people) the result of a process. Therefore, the question now remains, "Can we reform our habits?" and "Can we change or stop them?"

The answer to this question is complex, and no single hypothesis seems to fully answer this question. As people are such wonderful beings there will always be a percentage of any population able to do what seems to be impossible. We first need to know how habits are formed: the way habits are formed is the same process in which habits are changed and even stopped.

The Development / Forming of Habits

As indicated above, habits are not always developed because of a decision people make, a discussion they had with somebody, or even a firm instruction. Habits are formed/changed because of a process. A few critical ingredients are necessary for habits to form.

- The behavior must be associated with a meaningful goal as experienced by the person who develops the habit
- The behavior must be experienced by the person as successful in some way
- The facts are not at all important as long as the person subjectively and sometimes even irrationally experiences the behavior as successful
- There must be a relatively high number of repetitions. There is no consensus on the number of repetitions necessary to form a habit. The number of repetitions necessary to develop a habit depends on so many factors that it is impossible to calculate a responsible average number. Urgency, necessity, fear, peer group habits, rewards and routine are amongst many factors that influence the way habits are developed, especially the number of repetitions necessary to develop a habit.

Changing of Habits

The ways habits change are equally important. Despite the experience that some habits never change, they can do. In some instances, individuals are not at all able to change their habits (especially those habits that develop in relation to the very basic survival behavior of people). Examples would be eating habits, drinking habits, working and sleeping habits. Only a very small percentage of the population can change a habit by means of a decision. **It must be emphasized: Changing a habit is a process.**

The following types of situations (and combinations thereof) can be identified where people change their habits:

- Gunpoint: Adapt or die! When the person is faced with a crisis that poses a threat to the very basics of his/her existence, he/she might change/unlearn/ stop/start a habit in a very short period. E.g. 'If you don't teach yourself improved eating habits, you will die'. This constitutes a situation whereby someone has very little choice but change. In some instances, a relatively high percentage of people will still find it difficult to change their habits, especially when the habit pairs with substances such as smoking or eating habits.

- Habit Substitution: The person embarks on a program of replacing a specific habitual behavior with replacement behavior in order not to execute the habitual behavior. E.g. 'Cycling to work instead of travelling to work by bus. This is a real life case study. The individual has been travelling to work by bus for twelve years. She then developed health problems as a result of being overweight. Her surgeon recommended some form of physical exercise. She decided to start cycling to work instead of using the local public transport. She confessed that it was tough to "change my habit of sitting in the bus to hard physical exercise on a bicycle". She developed a habit of cycling to work, enjoyed it and she lost 30 pounds of weight.

- Group Habit Transfer: Habits can change when an individual with a specific habit becomes very involved with a group of people that collectively do not have the specific habit but behave according to a different habit in the same situation. E.g. 'You are in our boarding school now and in this school we all go to church on Sundays'. A young man started further studies at a strict Christian College. He had no habit of going to church on Sundays. All students in that particular boarding school went to church on a Sunday Morning. When he finished his degree this habit was so defined and well established that he consciously decided that he would only marry someone with the same habit!

- Habit Purpose Removal: As indicated elsewhere in this manual, habits are always associated with a purpose. If the purpose disappears, the habit might fade/disappear over time. It might even disappear immediately. E.g. 'You don't need to feed the owl anymore as, unfortunately it has died'. This individual took ownership of looking after an owl that lost its leg as well as one wing as a result of hunters shooting the owl but not killing it. She found the owl and made it her task to look after the bird. Over many years, she developed the habit of feeding the owl according to a precise routine, every day. When the owl died, the purpose of her routine was removed. For the first time in 13 years she went on vacation, and she experienced difficulties in changing her habits away from feeding the owl.

- Mentorship Programs: The most successful way of changing/developing/strengthening a habit is by means of a guided development program where the person participates in a well-managed, positive and meaningful program to unlearn unwanted habits and/or develop new habits to replace other behavior). E.g. 'Welcome to our fitness group, you will exercise with us and your personal trainer will guide and teach you what you need to know in order to succeed. Your trainer will also ensure that you complete all the outcomes of all the programs'. Shadowmatch provides the participating individual with Guided Mentorship Programs to help people develop the behavior (habits) they need in order to master the behavioral habits necessary to succeed in a specific environment doing a specific job. These programs have been designed to develop a habit towards a specific behavior.

3. Industry Research on Behavior & Performance

Habits and behavior as they relate to job performance

Human behavior has clear conceptual and empirical links to performance at work. Motowidlo, Borman, and Schmit (1997) proposed a widely used model of job performance in which they define performance as an "aggregated value to the organization of the discrete behavioral episodes that an individual performs over a standard interval of time" (p. 72). Furthermore, these researchers discuss how these behavioral episodes (job performance) can be predicted by an individual's habits or behavioral tendencies. The connection between behavioral tendencies and job performance has also been clearly shown with the broad characteristic of conscientiousness. Conscientiousness involves the extent to which individuals have the tendency to behave in "organized, exacting, disciplined, diligent, dependable, methodical, and purposeful" ways (Witt, Burke, Barrick, & Mount, 2002, p. 164). A large number of studies have now shown that this characteristic relates to job performance (Barrick, Mount, & Judge, 2001). Additional studies have also shown that other behavioral tendencies are significantly related to particular types of job performance (see Hogan & Holland, 2003).

Organizational culture and job success/performance

Organizational culture refers to a set of shared assumptions that guide how information is interpreted and what behaviors are considered appropriate for a given situation (Jex & Britt, 2008). According to Schein (1992), organizational culture is comprised of three levels. The first level is the visible elements including the artifacts, technologies, and patterns of behavior (or habits) that are displayed in the organization. The next two levels are the shared values of the members of the organization and the deeply held beliefs or assumptions that determine how situations are interpreted. According to Schein's framework, shared habits would be a first level component of organizational culture. An organization's culture, including the dominant habits shared by its members, develops through adaptation to the external environment (e.g., market forces) and the integration of members within the organization.

Kotter and Heskett (1992) conducted a large-scale study of 207 organizations to compare the strength of an organization's culture to a variety of performance metrics. They found that strong organizational cultures in which the norms and values are consistent and strongly held across the organization members produced significant differences in bottom-line organizational performance. Sørensen (2002) demonstrated that strong cultures increase the performance of firms during stable economic conditions. Strong organizational cultures likely improve performance through the development of routines that coordinate the efforts of employees. By reducing uncertainty and creating a unifying structure, a strongly held shared culture can improve collective performance. However, in another study, Denison and colleagues (2004) compared different types of cultures across 169 organizations and found that certain organizational cultures were strongly correlated with employee ratings of organizational effectiveness. Therefore, the strength of the culture or shared habits is important, but encouraging the correct values, beliefs, and habits across employees is also important for performance.

Overall, a strong adaptive culture has been shown to produce economic benefits for the overall organization. Apart from improving the collective effort of employees, it is also important to consider how organizational culture affects individual employee performance. It may be, for example, that the culture itself is highly adaptive and promotes habits (e.g., innovative thinking, attention to detail) that are conducive to individuals performing better at their jobs. However, another consideration is how well an individual fits into the organizational culture.

Hiring for the right cultural fit

Substantial research has demonstrated the important interaction between individuals and the environment in predicting performance (Kristof-Brown, Zimmerman, & Johnson, 2005). When a person "fits" the work environment or organizational culture well they are expected to experience positive attitudes, motivation, and increased performance. Cable and DeRue (2002) demonstrated that workers have varying degrees of fit with their job, the work-group, and/or the organization. Person-Organization fit (PO-fit) refers to the compatibility between an individual's values, beliefs, and behavioral patterns and the values, beliefs and behavioral patterns held by members of the organization. When individuals perceive congruence between themselves and the organization members and the organization as a whole they are more likely to identify with the organization (Turner, 1984).

Kristof-Brown, Zimmerman, and Johnson (2005) reviewed studies testing the effects of PO-fit. The results demonstrated that PO-fit was particularly influential in increasing employee organizational commitment, in lowering levels of job strain, and in improving contextual performance. Contextual performance refers to the extra-efforts or helpful behaviors individuals perform that go beyond their immediate job tasks and is a key driver of organizational success. For more complex tasks, organizations are continuing to ask individuals to go above and beyond their formal job roles to provide support for achieving objectives and take on new challenges. Identifying with the members of the organization through a shared culture likely motivates individuals to work together and provide support when needed.

Chatman and Cha (2003) argue that successful members of organizations will occupy multiple jobs over time and that what links all those jobs is the organizational culture. Hiring individuals that fit the organizational culture is an important strategy for developing personnel resources. Employees can always learn new skills, but having congruence between their beliefs, values, and habits, and those in the greater organization will maintain their motivation to remain in the organization. Additionally, hiring individuals based on certain characteristics is an intervention method that over time can change the organizational culture. By rewarding particular habits within the organization and selecting employees based on their propensity to demonstrate those habits, organizational leaders can effectively alter the organizational culture and develop new habits that are more adaptive for performance. Although many habits are likely adaptive, leaders can improve their organizations by identifying the key habits necessary for high performance and selecting individuals with the propensity to display those habits. However, those habits would likely be different based on the type of organization.

Habits and behaviors required/identified for specific jobs/roles

Research has demonstrated the utility of placing individuals with specific behavioral tendencies in congruent roles or jobs throughout the organization. Schneider's (1987) work supports this, suggesting that individuals are more likely to be attracted to, selected for, and retained in roles and organizations that fit their habits and tendencies. A recent meta-analysis also found that several broad behavioral tendencies had statistically significant relationships with turnover intentions and behaviors (Zimmerman, 2008). Similarly, Lounsbury, Steel, Gibson, and Drost (2008) suggest that a lack of "fit" may cause employee dissatisfaction. This research suggests the importance of fitting an individual's habits and behaviors with the correct job.

The effect of habits and behaviors on human interaction

Creating a productive work team is complex and quite different from selecting a single individual to work on an independent job. The organization must not only assess whether team members have the knowledge, skills, and abilities to perform their job well, but also make sure they can work well with other team members. This process is often referred to as "forming" the team, and is the first main process in team development (Ilgen, Hollenbeck, Johnson, & Jundt, 2005). One research avenue that has produced useful insight into how to build an effective work team focuses on examining and matching team members' habits and behaviors. In the following paragraph, we will review what researchers have found in regards to how important habits/behaviors are in producing an effective team.

Barrick and colleagues (1998) demonstrated that teams with higher mean levels of conscientiousness and general mental ability received higher supervisor ratings. The researchers also found that teams with higher mean levels of extraversion and emotional stability were rated as being more viable (which refers to a team's ability to continue working productively as a unit). Furthermore, these relationships were mediated by social cohesiveness. In other words, teams with higher levels of extraversion and emotional stability are more likely to work cohesively, which increases the team's ability to continue working productively in the future. Bell (2007) analyzed multiple prior studies in her meta-analysis and found the following results. Team levels of conscientiousness, openness to experience, and extraversion were positively related to team performance (in field settings). Also, team collectivism, preference for teamwork, and emotional intelligence were positively related to teamwork. Bell's findings support the notion that selecting team members that share high levels of these variables should result in more effective and cooperating teams. Lastly, Resick and colleagues (2010) demonstrated that team agreeableness was related to mental-model similarity among team members, which was, in turn, related to team viability. In other words, teams composed of agreeable members are more likely to perceive/model their tasks and performance domains in the same way, which then leads team members to believe they can collaborate effectively in the future.

The research reviewed above demonstrates the importance that habits and behavioral tendencies play in team effectiveness and viability. Our tendencies impact our interaction with others, which influences how well we can work as a team. Therefore, team member selection needs to focus on each member's habits in order to produce a productive team.

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4. The Shadowmatch System: An Overview

Shadowmatch as a system provides the following capabilities to business:

- It compiles a behavioral map of the shared habits of successful people doing the same job in the same environment
- It compares the habits of an individual to the habits of the successful benchmark group in order to determine the individuals' probable propensity to succeed in doing the same job in the same environment
- It compiles Personal Development Programs to develop the correct habits that will increase the success of an individual
- It provides customized Interview Packs for the interview panel when an individual is interviewed for employment/studies/developmental purposes
- It generates a Shadowmatch Recruitment Specification against the shared strong habits of the top performers in a specific working environment

These capabilities support a range of business services that cover the entire employee lifecycle:

- **Precision Recruitment** - A business and job unique benchmark made up of top performers is used to recruit and develop individuals for best performance in a job. The system provides interview packs and system based comparisons between the behavioral patterns (habits) of an individual compared to that of top performers in the business doing a specific job under specific conditions.
- **Personal Development** – The system assists new recruits, as well as current employees to develop those areas in which they lack the right behavioral habits in order to maximize their success in a specific position or division. This is achieved by providing Personal Development Programs in the form of guided practical learning outcomes to develop those areas necessary for the individual to grow towards better performance in the organization or specific division or position. These programs are customized for the specific context of the given position.
- **Career Development** - Shadowmatch assists the business and the individual in finding a career path that works for the success of both. It matches an individual to top performers and highlights positions / roles / divisions in which the individual will be successful.
- **Talent Identification** – Shadowmatch enables an employer to create a benchmark of the most talented individuals in the business. The company database of employees can now be searched for other talented individuals that could be developed for deployment into key future positions in a business.

- **Succession Planning** –Succession planning as a structured framework towards replacing key people in the business with equally competent individuals when the former moves on is a serious challenge. Shadowmatch is the perfect system to successfully meet this challenge.

- **Placement Audit** - Shadowmatch has in many instances been used to do a placement audit of a division or an entire company. The outcome is an indication of employees that are placed in positions where they have a propensity to fail as well as development actions that will help them grow their success.

- **Team Building** - Shadowmatch enables the facilitation of a powerful and constructive team building session. It empowers individuals and teams by giving them insight into their own behavioral patterns as well as the habit patterns of the team.

- **Conflict Facilitation** – The Shadowmatch capability of matching the behavioral patterns of two individuals that are not getting along enables the user to identify the reasons for the conflict. Shadowmatch also successfully assists in finding the reasons for team conflict.

- **Redeployment of People / Restructuring** - Shadowmatch enables the user to precision place people. If a department closes down or a merger happens, the tool is very useful and accurate in finding the best role and division to place individuals.

- **Leadership Identification** - Once the most successful leaders in the business have been identified, the tool enables the user to search through all the ranks in the business for individuals that show the same behavioral patterns as the successful leaders. These individuals can now be developed towards being a successful future leader in the business.

- **Coaching** - The Shadowmatch results page provides insight into the behavior patterns of an individual and empowers a manager / mentor / business coach to deliver accurate and meaningful coaching.

The Spirit of Shadowmatch

Shadowmatch supports a very deliberate effort of working positively with people.

The results presented by Shadowmatch show the way it has transformed the answers provided by an individual to a visible behavioral chart that represents no negative information about the individual. When a graph represents low scores on some habits, it indicates that the individual does not seem to manage that area of his/her life with behavioral patterns so well defined that we could refer to the behavior as a habit. A good example is the result of the individual's propensity to own a task versus his/her propensity to hand a task to an outside agent to execute. If the individual, for instance, scored 24 points on his/her propensity to own a task it indicates that it is not a habit of the individual to take ownership of the majority of jobs to be done. If the score is above 50 points, we can safely say that this individual has developed a habit to take ownership of a job that needs to be done. The higher the score, the more defined and well developed the habit. It must be emphasized that when a person has developed a habit in doing something, executing the habit is easy. This is why habits

indicate the level of ease with which someone acts when doing something that has been developed as a habit. The opposite is not necessarily true. If an individual does not have the habit of behaving in a specific way, it does not indicate an inability to do it. It means that the person does not do this as a habit. Normally (but not always) the individual finds it slightly more challenging to do something that is not defined/developed as a behavioral habit in his / her behavioral patterns.

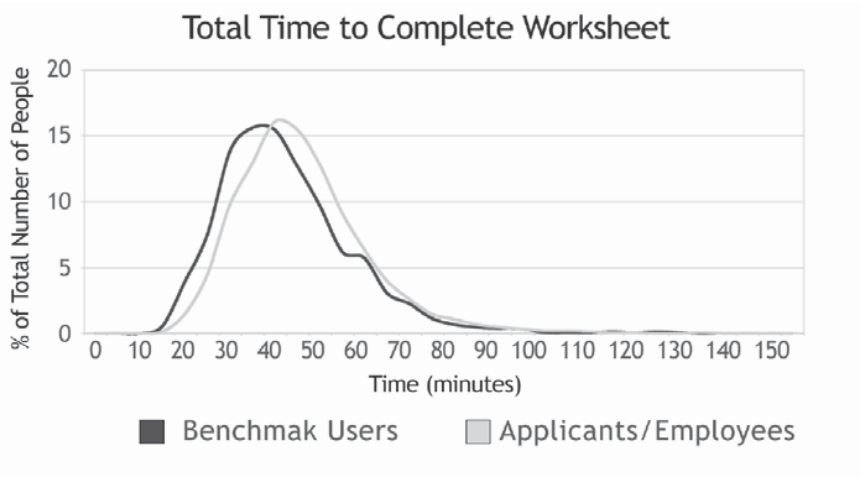
In conclusion, it happens from time to time that others do not experience people in the same manner indicated by the Shadowmatch results. In other words, we sometimes experience one another differently from our habits. This is normal. Shadowmatch draws patterns of behaviors. It creates patterns of actions we take in certain situations. It does not indicate if we are nice people, or whether we are friendly or unfriendly. It is a statement of actions we take when we engage with our world. These actions might be different from the persona we project in relationships.

5. STATISTICS: Visualizing the Shadowmatch Data

The power of Shadowmatch lies in its ability to display complex information in a way that makes it easy to see trends and relationships between different groups of people.

Time

A Shadowmatch worksheet does not have time limit, but individuals are recommended to keep 1 hour open to complete the worksheet. This graph shows the range of how long it actually takes most people to complete the worksheet:



The graph has been split between Benchmark users and the Applicant/Employee users. The graph shows an average time of about 40 minutes to complete the worksheet, with a few people taking a lot longer. The shift in time taken between the two groups is probably due to the difference in environment, expectation, and familiarity with working on computers.

The top 10 longest-to-answer questions happen to be the 10 conceptual questions in the worksheet.

Conceptual Questions

Conceptual questions measure the habit to apply one's mind to working through an abstract problem towards finding the correct solution. For the other worksheet questions there are no right or wrong answers, but the conceptual questions have a single correct answer.

- Less than 1% of people have achieved 10/10 for the conceptual questions... The quickest time to answer all 10 conceptual questions correctly is 10 minutes.

- The question most people spend the longest on (on average 02:21 min) is:
    - "You have to deliver a parcel. All the streets in the suburb where the delivery must be made are straight from end to end. The person directing you to the delivery address tells you that the building is to the south of Kumba Road. Which one of the following doesn't make sense?"
    - The length of time is due to the nature of the question, and the long answers, and the fact that you have to go through all of them to find the incorrect answer.
- Most people get the above question right; the following question, however, is the most incorrectly-answered conceptual question:
    - "You are fifteen minutes early for an appointment. In the waiting room, you face a large mirror against the wall opposite you. You can see the image of a round wall clock in the mirror. The clock has no numbers and the hands of the clock (as you see it in the mirror) indicate that the time is 7:45am. This time does not make sense to you. Then you realize that the real clock hangs upside down. What is the correct time of your appointment?"
    - Only 18% of people get this one right. It is a challenging question that measures a conceptual application of bending space and time!

Non-Conceptual Question:

After the 10 conceptual questions, the next longest-to-answer question is:

> "Imagine being a waiter at one of the top three restaurants in your country. A customer orders a meal and you place the order with the kitchen. You serve the meal to your customer and he asks you to check the order. You check it and confirm it with the customer. The customer later says that the meat is well-done and he asked for rare. He then starts an argument. It is not your mistake, what do you do?"

It is evidently a question that people can relate to and takes, on average, 56 seconds to answer. The full answers are:

1. Call the manager to help you handle the customer.
2. Take the food back to the kitchen to be replaced and ignore the customer.
3. Try to convince the customer that it is not your mistake but you will fix it.
4. Offer the customer a free drink and a freshly made meal to defuse the situation.

Interesting to note that the Benchmark users usually responded that they would take things into their own hands and "defuse the situation" (4) more than the Applicant/Employees, who were slightly more likely to "call the manager" (1).

This question shows some of the variation between Benchmark users and Applicant/Employee users and seems to hint at what makes one person more successful than another. This is only one question in isolation though and not too many conclusions should be drawn from it; Shadowmatch always looks at the bigger picture to give a fair and balanced perspective.

Variations Based on Gender:

There are other ways the user base could be segmented such as age, race or nationality. However, research and history have shown that these have little indication as to the habits of a person, so are not typically collected by Shadowmatch. The user's gender can be recorded, but it is not used for measuring or comparing habits. Overall Shadowmatch has an almost exact 50:50 percentage split between male and female users. Comparing their answers also shows very little difference in answering patterns or time taken.

Habits

The top six strongest habits of Benchmark users are, in order of rank:

1. Responsiveness
2. Discipline
3. Conflict Handling
4. Self Confidence
5. Team Inclination
6. Altruism

Since benchmark users are chosen as the top performers in roles, one might think that these 6 habits represent the habits of highly successful people. However, when compared with the Applicant/Employee's top strongest habits, they are very similar (the two sets of rankings consist of the same habits, but the order is slightly different). This is because there is no "ideal" person or set of habits that produces success. Each job/company/environment is unique and will have its own unique conditions, expectations and behavioral requirements.

Conclusion

The one key thing the Shadowmatch data and statistics support is that it is very difficult to measure what creates a successful person. This is one of the concepts that makes Shadowmatch so amazing and sets it apart from other systems and processes: it doesn't look for the "average" good employee, but rather it looks for the "unique" individual who will fit best into an environment where they have the greatest chance of success.

6. Shadowmatch Validation

6.1 Reliability & Construct Validity Studies

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Prepared by: The Center for Organizational Effectiveness at Florida Tech

Date: 12/18/2013

Executive Summary

This report examines the reliability and construct validity of the habit measures within the Shadowmatch Worksheet. Evidence related to reliability was obtained by investigating the test-retest reliability of the Shadowmatch Worksheet habit measures. Specifically, Shadowmatch habit scores were collected from 24 participants twice, with a three-week interval between collections. Results indicated that test-retest reliability was generally acceptable. Evidence related to construct validity was obtained by investigating the convergent and discriminant validity of the Shadowmatch Worksheet habit measures. In particular, scores on 19 Shadowmatch habits as well as the "Task Efficiency" scores were compared to scores on 15 previously validated personality measures. Each Shadowmatch variable was matched with a theoretically similar (convergent) and a theoretically distinct (discriminant) personality construct. Data were collected from 115 participants who took both the Shadowmatch Worksheet and the 15 additional measures. Results demonstrated strong evidence of construct validity, as all of the habits had statistically significant relationships with their theoretically related constructs, and all the habits demonstrated non-significant relationships with their theoretically unrelated constructs. These studies therefore provide support for the reliability and construct validity of the Shadowmatch Worksheet.

Introduction to Construct Validity

Reliability refers to consistency in measurement. Reliability is a basic measurement issue that should be examined whenever feasible, as measure reliability places a ceiling on validity estimates. A common approach to establishing reliability is to demonstrate consistency over time (test-retest reliability). Examining the reliability of the Shadowmatch measures therefore involved administering the Shadowmatch Worksheet to a sample of individuals twice over a period of time.

Construct validity refers to the extent to which a measure assesses the theoretical construct it is intended to measure. Evidence of construct validity adds credibility to the measures being used and the subsequent inferences drawn from them. A common approach to establishing construct validity is to demonstrate the measure's convergence with theoretically related measures and divergence from theoretically unrelated measures. Examining the construct validity of the Shadowmatch measures therefore involved a three step process. First, we developed theoretical expectations regarding the connections between the Shadowmatch habits and other established psychological constructs based on conceptual analysis of these habits and several well-established constructs in the psychological literature. Second, we measured these habits (using the Shadowmatch Worksheet) and other constructs (using previously validated measures) in a sample of individuals to examine relationships between them. Finally, we compared the empirical results (from the second step) to the theoretical expectations (from the first step), with consistency between these results and expectations interpreted as evidence supporting construct validity for the Shadowmatch Worksheet.

Reliability Study: Method

Participants

Participants for this study were 24 students from a southeastern university. Of these participants, 21% were males.

Procedure

Participants were recruited through a faculty member at the university. First, participants were sent an email with the Shadowmatch Worksheet link and were given four days to complete the Worksheet. Then, three weeks later, participants were sent another email with the Shadowmatch Worksheet link and were again given four days to complete the Worksheet.

Measures

The only measure used in this study was the Shadowmatch Worksheet. All 19 Shadowmatch habits were examined, as well as Conceptual Capabilities, Task Efficiency, and the four Attitudes.

Reliability Study: Analysis & Results

First and second round habit scores were correlated in order to examine the test-retest reliability of the Shadowmatch Worksheet. A correlation coefficient of .70 or higher is often considered evidence of acceptable test-retest reliability. The resulting bivariate correlations are as follows: Conceptual Capabilities (.51), Propensity to Own (.86), Propensity to Hand-Off (.68), Propensity to Simplify (.54), Resilience (.71), Propensity to Change (.70), Frustration (.85), Team Inclination (.72), Individual Inclination (.55), Self-Motivation (.82), Routine (.84), Problem Solving (.54), Responsiveness (.70), Innovation (.72), People Positive (.67), Discipline (.85), Conflict Handling (.72), Altruism (.65), Self-Confidence (.81), Leadership (.77), Task Efficiency (.56), Attitude 1 (.73), Attitude 2 (.81), Attitude 3 (.56), and Attitude 4 (.67). Table 1 provides a summary of these results.

Of the 25 correlations, only 10 were below the .70 cutoff and four of those were between .65 and .68. The six measures that were noticeably below .70 (.56 or lower) include Conceptual Capabilities, Propensity to Simplify, Individual Inclination, Problem Solving, Task Efficiency, and Attitude 3. It should be noted that Conceptual Capabilities, Propensity to Simplify, Problem Solving, and Task Efficiency may all contain a “time/speed” or intelligence component that would specifically be impacted by having to take the worksheet a second time. Therefore, the weaker test-retest reliabilities are not necessarily indicative of a measurement problem. Overall, these results support the reliability of the Shadowmatch Worksheet.

Construct Validity Study: Method

Participants

Participants for this study were 115 individuals recruited through an online crowdsourcing tool. Of these participants, 56% were female and 76% were under the age of 40. Split by race, 23.5% were African American, 23.5% were Asian, 25.2% were Hispanic, 23.5% were Caucasian, and 4% reported their race as "Other."

Procedure

Participants were recruited using Amazon's crowdsourcing tool named Mechanical Turk (M*Turk). This tool allows individuals (M*Turkers) from around the world to complete tasks and surveys for researchers and practitioners in exchange for monetary payment. Studies have demonstrated that M*Turk data are almost indistinguishable from data obtained from conventional laboratory research[1] and other online samples.[2] This study focused on US participants and thus only US M*Turkers were recruited. Only M*Turkers who had 95% of their previous questionnaire responses approved were allowed to respond to the study announcement. Several announcements requesting participants from specific demographic groups (African American, Asian American, Caucasian, Hispanic) were published on the M*Turk website. Participants responding to the study's announcement were directed to the Shadowmatch Worksheet. Once each participant completed the Shadowmatch Worksheet, his or her demographic information and rate of completion were recorded. If participants completed the assessment in less than 10 minutes, they were rejected and not compensated for their participation. The rest of the participants were compensated through the M*Turk system for proper completion of the assessment. Finally, 215 of these participants were contacted again by email and asked to fill out a second set of measures consisting of a variety of well-established personality measures. Of those 215, 115 filled out of the second set of personality measures.

Measures

For the Shadowmatch measure, 19 habits from the Shadowmatch Worksheet as well as time efficiency were included in the assessment. For the second set of measures, 15 previously validated personality instruments from the public domain version of the NEO-PI-R (IPIP)[3] were used. All of these measures showed good reliability, with Cronbach's alphas ranging from .78 to .97. More specifically, the alpha coefficients were as follows: Adventurous (.78), Agreeableness (.84), Altruism (.90), Assertiveness (.90), Cautiousness (.91), Conscientiousness (.97), Cooperation (.84), Gregariousness (.92), Intellect (.89), Neuroticism (.90), Openness (.79), Self-Discipline (.94), Self-Efficacy (.88), Trust (.94) and Vulnerability (.91). Each of these variables (with the exception of Conscientiousness) was measured with 10 items using 5-point scales asking participants how well the statement described them (1= very inaccurate, 5 = very accurate). Conscientiousness was measured using 60 items and the same 5-point scale.

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[1] Sprouse, J. (2011). A validation of Amazon Mechanical Turk for the collection of acceptability judgments in linguistic theory. *Behavior Research Methods*, *43*(1), 155-167.

[2] Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's Mechanical Turk A New Source of Inexpensive, Yet High-Quality, Data? *Perspectives on Psychological Science*, *6*(1), 3-5.

[3] Goldberg, L. R. (1999). The International Personality Item Pool (IPIP) is a free well-validated public domain personality assessment based on Costa and McCrae's (1992) NEO Personality Inventory.

Construct Validity Study: Analysis & Results

Each Shadowmatch Worksheet habit was linked to two personality measures, with one being theoretically related (convergent) and the other theoretically unrelated (discriminant). Bivariate correlations were run using SPSS data analysis software to examine the magnitude and statistical significance of those relationships. As shown in Table 2, the relationships between the Shadowmatch Worksheet habits and the other personality measures demonstrate strong evidence of both convergent and discriminant validity.

Summary & Conclusions

Based on the results of our analyses, there is support for the reliability and construct validity of the Shadowmatch Worksheet. First, the majority of Shadowmatch Worksheet measures demonstrated test-retest reliabilities above .70. The measures that fell below this cutoff may have a "time/speed" or intelligence component that may have affected results. Second, all of the Shadowmatch Worksheet habits demonstrated convergent validity, with significant relationships observed between the habits and the theoretically related constructs. Finally, all of the Shadowmatch Worksheet habits demonstrated discriminant validity, with non-significant relationships observed between the habits and the theoretically unrelated constructs. In combination, this indicates that the empirical results are consistent with the theoretical expectations, supporting the construct validity of the Shadowmatch Worksheet.

Table 1: Test-Retest Reliabilities

Shadowmatch Habit	Reliability
Conceptual Capabilities	.51
Propensity to Own	.86
Propensity to Handoff	.68
Simplify	.54
Resilience	.71
Change	.70
Frustration	.85
Team Inclination	.72
Individual Inclination	.55
Self-Motivation	.82
Routine	.84
Problem Solving	.54
Responsiveness	.70
Innovation	.72
People Positive	.67
Discipline	.85
Conflict Handling	.72
Altruism	.65
Self Confidence	.81
Leadership	.77
Task Efficiency	.56
Attitude 1	.73
Attitude 2	.81
Attitude 3	.56
Attitude 4	.67

Table 2: Bivariate Correlations

Shadowmatch Habit	Convergent	Discriminant
Propensity to Own: take ownership of things that need to be done; doing things by yourself	**Self-Discipline (.34***)**	**Adventurous (.10)**
Propensity to Handoff: allowing others to do work for you	**Cooperation (-.24**)**	**Adventurous (.07)**
Simplify: breaking complicated challenges down into simple, linear problems that can be resolved more easily	**Neuroticism (-.20*)**	**Altruism (.02)**
Resilience: relentlessly applying yourself to complete a difficult task	**Vulnerability (-.36***)**	**Altruism (.15)**
Change: being comfortable with change; a preference for change rather than being stagnant	**Openness (.19*)**	**Conscientiousness (.10)**
Frustration: how one deals with frustration (e.g., positive, negative, passive)	**Vulnerability (-.39***)**	**Openness (.18)**
Team Inclination: strong preference towards working as part of a team	**Trust (.29**)**	**Intellect (.07)**
Individual Inclination: strong preference to working in isolation or by yourself	**Gregariousness (-.41***)**	**Intellect (.01)**
Self Motivation: extent to which one is generally intrinsically motivated	**Self-Discipline (.43***)**	**Openness (.08)**
Routine: tendency to organize your world towards strict patterns of sameness	**Conscientiousness (.19*)**	**Altruism (.18)**
Problem Solving: habit (ability) of comfortably engaging in problems	**Intellect (.23*)**	**Altruism (.12)**
Responsiveness: preference towards acting immediately when being given a job to do	**Assertiveness (.25**)**	**Openness (.14)**
Innovation: initiative towards creating new technologies or methods	**Adventurous (.23*)**	**Agreeableness (.08)**
People Positive: types of relationships built with others (e.g., positive, negative)	**Cooperation (.22*)**	**Cautiousness (.03)**
Discipline: a pattern of behavior towards working and living under strongly regulated conditions of order, systematic procedures	**Self-Discipline (.36***)**	**Adventurousness (.06)**
Conflict Handling: preference of dealing with conflict (positive manner, negative manner)	**Agreeableness (.21*)**	**Self-Discipline (.03)**
Altruism: helping other people in need without expecting any form of compensation	**Altruism (.20*)**	**Intellect (.11)**

Self Confidence: behavior that shows that a person trusts his/her own abilities towards doing a job successfully	**Self-Efficacy (.25**)**	**Adventurous (.07)**
Leadership: behavior of guiding and energizing a group of people towards a goal	**Assertiveness (.36***)**	**Openness (.08)**
Task Efficiency: how quickly and accurately one completes tasks	**Conscientiousness (-.20*)**	**Adventurous (-.05)**

Note: The numbers in parentheses are the correlation coefficients, with higher numbers indicating a greater degree of relationship between the two variables. The asterisks indicate the level of statistical significance of the correlation such that a *p* value < .05*; < .01**; < .001***. The lower the *p* value the greater the statistical significance. Traditionally, a *p* value less than .05 is considered statistically significant.

6.2 System Validation

Shadowmatch Introduced

Shadowmatch is a 'Black-box' type tool that presents an individual with a list of tasks in order to determine habits in the behavior of the individual. It simulates tasks for the individual to indicate how he/she will act by selecting from a list of multiple answers. The system then identifies trends in the way an individual has indicated how he/she will act in the specified circumstances and calculates the consistency with which answers were selected. The result is a graph that indicates the level to which these habits are embedded in the behavior of the individual as per a set of behavior definitions. A high score indicates that the individual has consistently selected answers that indicate a strong preference towards behaving in a specific manner. A low score indicates that the individual didn't consistently select answers that would represent congruent behavioral patterns of the specific nature calculated as a habit. On the list of 19 habits, the score can even be less than zero. This indicates an anti-habit also referred to as a counter habit. The person then indicated a habit against the habit being calculated.

Statement of Experiment

Assertion: Shadowmatch asserts that by having an individual complete a list of tasks (in the format of a questionnaire-based worksheet) Shadowmatch can discriminate the level or degree to which habits are embedded in the behavior of an individual as per a set of defined behavior categories.

The requirement is to design an experiment by means of which the above assertion can be tested with a view towards validation. Our experiment consists of the following:

1. Inviting eight 'experts' to complete a total of 36 Shadowmatch worksheets profiling 18 separate behavior categories such that 18 result in a score of 70 or more (demonstrating the presence of a habit imbedded in the behavior of an individual) and such that 18 result in a score of 10 or less (demonstrating the absence of a habit embedded in the behavior of the individual).

2. The eight experts were not told in advance which behavior pattern they would profile. Once seated, each was provided with access codes to complete a Shadowmatch worksheet and each was randomly assigned a separate behavior category with a definition of that behavior category.

3. For each behavior category, an expert was tasked to complete two Shadowmatch worksheets.

    a. One: complete a worksheet, consistently selecting for each question the answer that they (the tasked expert) felt best described behavior that was consistent with the behavior definition supplied, and …

    b. Two: complete another worksheet, consistently selecting for each question the answer they felt was most anti / contra the behavior as per the behavior definition.

Interpretation and Its Reasoned Basis

In considering the appropriateness of the above experimental design, it is needful to forecast all possible results of the experiment and to have decided without ambiguity what interpretation shall be placed upon each result. In this instance, we set out the possibilities as per the mathematics of permutations and combinations for the 18 results out of 36 total tests that targeted a score of 70 or more. In determining the full set of possible permutations, it is noted the order does not matter and a particular result can only be used once. Consequently, the number of possible combinations is the binomial coefficient:

$$\binom{n}{k} = \frac{n!}{k!(n-k)!}$$

For our calculation, n = 36 and k = 18. There are a total of 9,075,135,300 (just over 9 billion) possible sets of answers ranging from all 18 targeted behavior categories scoring 70 or more to all 18 targeted behavior categories scoring less than 70. At best, the experts can complete the worksheets so consistently as per the behavior definitions that all 18 targeted behavior categories result in a score of 70 or more. In terms of probability, experts without any faculty of discrimination against the definitions would emulate this result (all 18 scoring 70 or more) in one trial out of 9,075,135,300.

The complete set of probabilities is enumerated in the following table:

Behaviors Scoring 70+ out of 18	Behaviors Scoring less than 70	Frequency	Significance	Confidence
18	0	1	0.00000001%	99.99999999%
17	1	324	0.00000357%	99.99999643%
16	2	23,409	0.00025795%	99.99974205%
15	3	665,856	0.00733715%	99.99266285%
14	4	9,363,600	0.10317863%	99.89682137%
13	5	73,410,624	0.80892044%	99.19107956%
12	6	344,622,096	3.79743204%	96.20256796%
11	7	1,012,766,976	11.15980030%	88.84019970%
10	8	1,914,762,564	21.09899743%	78.90100257%
9	9	2,363,904,400	26.04814498%	73.95185502%
8	10	1,914,762,564	21.09899743%	78.90100257%
7	11	1,012,766,976	11.15980030%	88.84019970%
6	12	344,622,096	3.79743204%	96.20256796%
5	13	73,410,624	0.80892044%	99.19107956%
4	14	9,363,600	0.10317863%	99.89682137%
3	15	665,856	0.00733715%	99.99266285%
2	16	23,409	0.00025795%	99.99974205%
1	17	324	0.00000357%	99.99999643%
0	18	1	0.00000001%	99.99999999%

Table 1: Full set of possible results (normal distribution curve):

The Test of Significance

In relation to test of significance, we can conclude that something is demonstrated experimentally when we can conduct an experiment in such a way that it will rarely fail to give us a result that can be interpreted against a statistical significance score. Table 1 (above) details all the possible results of the experiment as pertains to demonstrating a habit embedded in the behavior of an individual (that is a score of 70 or more resulted for the behavior category targeted). It is noted that the sum of the frequency above equals the total number of possible combinations of 9,075,135,300. The significance score is calculated as: [frequency divided by 9,075,135,300].

In deciding the level of significance to use, we want to avoid high degrees of success that can result from mere chance. Hence, we target a level of significance of 0.01 for a 99% plus confidence index in our results.

The Null Hypothesis

Our exploration of the full set of possible results of the experiment has resulted in a statistical test of significance by which the actual results can be divided into two classes of opposed interpretation. The two classes of results which can be distinguished by our test of significance are …

1. Referenced as the 'null hypothesis': the hypothesis that the experts' collective efforts to discriminate the presence of a strong habit as well as the absence of a habit embedded in an individual's behavior as per a set of behavior definitions are not enabled by the Shadowmatch worksheet,

2. Referenced as the 'alternative hypothesis': the hypothesis that the experts' collective efforts to discriminate the presence of habits (strong and absent) embedded in an individual's behavior as per behavior definitions are enabled by the Shadowmatch worksheet.

It is noted that this experiment ('validation of Shadowmatch') has been created to give the evidence a chance to disprove the null hypothesis and not to prove or establish it.

It is tempting to argue that if the validation of Shadowmatch (the experiment) can disprove the null hypothesis, we must consequently be able to prove the opposite hypothesis namely that experts can discriminate the presence of habits embedded in an individual's behavior as per a set of definitions using the Shadowmatch worksheet. However, this opposite hypothesis is ineligible as a 'null hypothesis' because it is inexact. If we would add the words 'always be able to discriminate the presence of a habit embedded', we would then have an exact hypothesis that can operate as a 'null hypothesis'. However, it is easy to see that this hypothesis can be disproved by a single failure whilst never being proved by any finite number of experiments. From this example, it is clear that the 'null hypothesis' must be precise and unambiguous in order for it to supply the basis of the 'problem of distribution', for which the 'test of significance' is the solution.

Randomization: The Physical Basis of the Validity of Shadowmatch

We have discussed that the validation of Shadowmatch involves testing the null hypothesis that the Shadowmatch worksheet does not enable experts to discriminate the presence of an embedded habit. We have also assigned, as appropriate to this hypothesis, a frequency distribution of occurrences, based on the equal frequency of the 9,075,135,300 possible ways of assigning the results of 36 Shadowmatch worksheets to two habit sets (embedded and absent) of 18 behavior areas each. This is in fact the frequency distribution for a classification by pure chance.

We have now to consider the physical conditions of the experimental design required to substantiate the assumption that, if the link between experts being able to use the Shadowmatch worksheet and behavior definitions to model the degree of habits embedded in an individual's behavior is absent, the results of the experiment conducted will be completely controlled by the laws of chance. It is easy to see how the physical conditions of the experiment can deliver results not completely controlled by the laws of chance. For example, if, for each question in the Shadowmatch worksheet, an expert had a choice between two answers highlighted

in different colors to consistently indicate the absence or presence of a habit embedded in the behavior set under modeling, then the obvious difference in the format of the question answers would ensure that a set of both high scores and low scores result. This would happen in 50% of all trials and the sets would either be all right or all wrong and the test of significance would be meaningless.

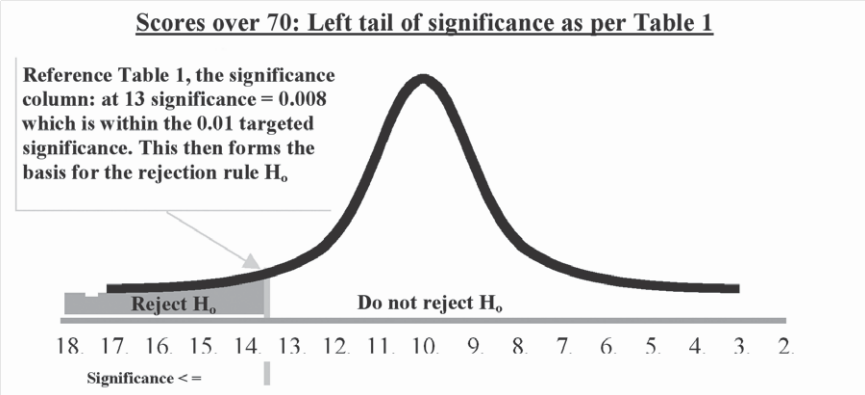
In this particular instance, we needed to take the precaution of randomization to guarantee the validity of the test of significance against which to decide the experiment results. This was done through behavior sets being randomly assigned to each of the eight experts. For each specific behavior area the expert was required to complete a Shadowmatch worksheet to model both the presence and absence of a habit embedded in an individual's behavior as per the behavior definition. The worksheet targeting a specific behavior could only be completed once by the expert in question. Second attempts at modeling the behavior are not a part of the experiment results – first attempts only have been included.

With respect to any additional refinements that can be made to increase the sensitivity of the experiment, we now have in place the description of a valid experiment as well as the test of significance by which to determine its result. It remains for us to translate the hypotheses into numerical constructs, to present the actual results of the experiment and to conclude on the validity of Shadowmatch.

Hypotheses H_o and H_a and Rejection Rule H_o

Null Hypothesis:	H_O: Shadowmatch does not discriminate the presence of habits
Alternate Hypothesis:	H_a: Shadowmatch does discriminate the presence of habits

We want a 99% chance of discriminating the presence of habits embedded in an individual's behavior. Hence, the level of significance for the hypothesis test is 0.01 (or 1%). If you reference Table 1 earlier, you will see that the significance scores for a total of 13 to 18 tests scoring greater than or equal to 70 are all less than 0.01 (1%) and thus within the 0.01 significance level. This band thus forms the basis for our rejection rule Ho detailed below.



Given Table 1, a significance level of 0.01, the above visual and the fact that the same logic applies to the results targeting scores of 10 or less, we can establish the following rejection rule:

- Reject Ho: If 13 or more of the 18 worksheets completed to show the presence of a strong habit embedded in an individual's behavior score greater than or equal to 70.

  OR

- If 13 or more of the 18 worksheets completed to show the absence of a habit embedded in an individual's behavior score less than or equal to 10.

The Experiment Results

The expert group of eight could successfully replicate the presence /absence of behavioral habits as is presented in table 2 below. (Manipulating the results equal to or above 70% should be seen as 100% successful and creating a result of less than or equal to 10% in order to anticipate the absence of a behavioral habit, that should also be seen as 100% successful).

No	Habit	Forced High	Count of Successful	Forced Low	Count of Successful
1	Propensity to own	71%	1	19%	
2	Propensity to hand-off	64%		13%	
3	To Simplify	70%	2	9%	1
4	Resilience	83%	3	-23%	2
5	Propensity to Change	70%	4	3%	3
6	Frustration Handling	73%	5	-6%	4
7	Team Inclination	96%	6	4%	5
8	Individual Inclination	72%	7	6%	6
9	Self-Motivation	81%	8	-2%	7
10	Routine	55%		12%	
11	Problem Solving	79%	9	-6%	8
12	Responsiveness	88%	10	3%	9
13	Innovation	83%	11	-14%	10
14	People Positive	85%	12	-14%	11
15	Discipline	69%		12%	
16	Conflict Handling	67%		3%	12
17	Altruism	80%	13	-10%	13
18	Self Confidence	78%	14	-9%	14

Table 2: Experiment Results (36 results made up of two sets of 18)

Conclusion

Set one produced 14 scores of 70 or more and set two also produced 14 scores of 10 or less. As this is greater than the 13 limit as specified in rejection rule Ho, we reject the null hypothesis that Shadowmatch does not discriminate the presence of habits embedded in an individual's behavior and accept the alternate hypothesis (Ha) that Shadowmatch does discriminate the presence of habits embedded in an individual's behavior with a significance of 0.01. This means that Shadowmatch gives a user of Shadowmatch a 99% probability of discriminating the presence of habits embedded in an individual's behavior as per the Shadowmatch behavior definitions.

Participants

1. Guy Krige: Independent Business Consultant
2. Erna Gerryts: Independent Control Group Participant
3. Theo Bezuidenhout: Independent Sport and Counseling Psychologist
4. Madi du Toit: Deloitte
5. Nelius Volschenk: Deloitte
6. Pieter de Villiers: Shadowmatch Representative
7. Lizette Bester Shadowmatch Representative
8. Hestie Byles: Psychologist University of Pretoria (partial participant)

7. Shadowmatch Adverse Impact Study

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Date: 11/5/2013

Executive Summary

This report describes research examining the potential for the Shadowmatch Worksheet to produce adverse impact for race or gender in a selection setting. All analyses and results should be applied only to selection-related settings/uses and not other settings/uses (e.g., team building, team analysis, new leader assimilation, top performer analyses, and other non-selection uses). Participants were 328 individuals recruited through an online crowdsourcing tool who completed the Worksheet and provided demographic information. The potential for adverse impact was examined using two approaches. The first approach involved examining mean differences across groups for the 21 habits. Mean differences between races were observed for 13 out of the 21 habits, and mean differences between genders were observed for 6 out of the 21 habits. These results are consistent with the expectation that there may be some demographic differences in the habits measured but also suggest further analyses examining selection rates may be useful in assessing adverse impact potential. The second approach involved examining five simulated selection scenarios. Participants were treated like applicants and selected for a hypothetical position based on their similarity to five different benchmarks (food industry, high tech, HR consulting, IT industry, and a demographic balance benchmark). This hypothetical selection process was carried out for three separate selection ratios (.1, .3, and .5). Results from these simulations indicated that there were some instances where the four-fifths rule for adverse impact was violated. However, additional *Z* test analyses indicated that these selection rate differences were not statistically significant. In addition, adverse impact patterns varied across the different benchmarks and selection ratios. In combination, results from these analyses suggest that the Shadowmatch system may not produce clear and consistent differences across groups in terms of selection outcomes, and adverse impact potential may be largely dependent upon local factors including selection ratio and benchmark composition.

Adverse Impact

Adverse impact is defined by the Uniform Guidelines on Employee Selection Procedures as a "substantially different rate of selection in hiring, promotion, or other employment decision

which works to the disadvantage of members of a race, sex, or ethnic group." Given this definition, it is important to emphasize that adverse impact considerations are relevant to selection-related settings/uses and not other settings/uses (e.g., team building, team analysis, new leader assimilation, top performer analyses, and other non-selection uses). There are several ways of examining a selection procedure's potential for adverse impact. In this study, two methods were used: mean difference and simulated selection analyses.

The mean difference analyses involve assessing mean differences across groups in a protected class. These analyses indicate whether statistically significant mean differences exist across groups as well as the magnitude of any differences. Results from these analyses thus provide evidence regarding adverse impact potential in that mean differences on a selection procedure can result in different selection rates, where the lower scoring group may be selected at a lower rate than the higher scoring group. However, because the Shadowmatch system involves selecting individuals based on how well they match a certain benchmark, scoring high on the Shadowmatch habits may not always lead to being hired. Therefore, we also used a simulated selection method to examine the potential for adverse impact that more closely aligns with the operational Shadowmatch system.

The simulated selection analyses involve analyzing results from a hypothetical selection process. In this method, participants who completed the assessment are examined to determine which of them would actually be selected in multiple hypothetical scenarios. Hiring rates for each group in a protected class can then be calculated as the number of individuals from a given group who are selected, divided by the total number of individuals in that group. Once these hiring rates have been obtained, they can then be analyzed to determine whether there is a difference in rates across groups. The four-fifths (or 80%) rule is a common guideline for analyzing hiring rates. The Uniform Guidelines on Employee Selection Procedures states this rule as: "A selection rate for any race, sex, or ethnic group which is less than four-fifths (4/5) (or eighty percent) of the rate for the group with the highest rate will generally be regarded by the Federal enforcement agencies as evidence of adverse impact, while a greater than four-fifths rate will generally not be regarded by Federal enforcement agencies as evidence of adverse impact." In other words, violations of the four-fifths rule in these simulated selection scenarios suggest a potential for adverse impact in the operational use of the selection procedure. In addition to the four-fifths rule, a *Z* test for differences in proportions can be performed to determine whether differences in hiring rates are statistically significant. If the value of the calculated *Z* score is less than -2.58 (corresponding to a significance level of .01), the hiring rates are significantly different.

Method

Participants

Participants for this study were recruited through an online crowdsourcing tool. A total of 371 participants completed the Shadowmatch Worksheet. After screening out participants who completed the Worksheet more than once and those who completed it in less than 10 minutes, the total sample was reduced to 328 participants. Of these participants, 58% were female and 77% were under the age of 40. Split by race, 24% were African American, 24% were Asian, 23% were Hispanic, 24% were Caucasian, and 5% reported their race as "Other."

Procedure

Participants were recruited using Amazon's crowdsourcing tool named Mechanical Turk (M*Turk). This tool allows individuals (M*Turkers) from around the world to complete tasks and surveys for researchers and practitioners in exchange for monetary payment. Studies have demonstrated that M*Turk data are almost indistinguishable from data obtained from conventional laboratory research[4] and other online samples.[5] This study focused on US participants and thus only US M*Turkers were recruited. We also limited the sample to M*Turkers who had 95% of their previous questionnaire responses approved. Several announcements requesting participants from specific demographic groups (African American, Asian, Caucasian, and Hispanic) were published on the M*Turk website. Participants responding to the study's announcement were directed to the Shadowmatch Worksheet. Once each participant completed the instrument, his or her demographic information and total time taken were recorded. If participants completed the assessment in less than 10 minutes, they were rejected and not compensated for their participation. The rest of the participants were compensated through the M*Turk system for proper completion of the assessment.

Results

Data analysis involved two approaches: (1) mean difference analyses and (2) simulated selection analyses. The following sections discuss each of these approaches.

[4] Sprouse, J. (2011). A validation of Amazon Mechanical Turk for the collection of acceptability judgments in linguistic theory. *Behavior Research Methods*, *43*(1), 155-167.

[5] Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's Mechanical Turk A New Source of Inexpensive, Yet High-Quality, Data? *Perspectives on Psychological Science*, *6*(1), 3-5.

Mean Differences

To examine mean differences across racial groups (African American, Asian, Hispanic, Caucasian, and "Other"), an Analysis of Variance (ANOVA) was conducted for each of the 21 habits the Shadowmatch Worksheet measures. The results demonstrated that 13 out of the 21 habits had at least one racial group scoring statistically significantly higher than another (see Table 1). The 13 habits that demonstrated significant mean differences were as follows: Conceptual, Propensity to Own, Simplify, Resilience, Self-Motivation, Problem Solving, Responsiveness, Innovation, People Positive, Discipline, Conflict Handling, Self-Confidence, and Leadership. Specific group differences for each habit can be found in Table 1, including standardized mean differences (Cohen's *d*) as an index of effect size. A common rule of thumb for these *d* values is: .20 is small, .50 is medium, and .80 is large. These differences thus tended to be medium to large in terms of effect size. Therefore, some differences between races were found but (a) these results are consistent with the expectation that there may be some demographic differences in the habits measured and (b) these findings do not necessarily mean adverse impact will be found, particularly given the Shadowmatch benchmark matching approach.

Table 1: Mean Differences in Shadowmatch Habits across Racial Groups

Habit	F-Value	Group Diff. (Cohen's d)	Group Diff. (Cohen's d)	Group Diff. (Cohen's d)	Group Diff. (Cohen's d)
CONCEPTUAL	2.90*	ASIAN > AA (.46)			
PROPENSITY TO OWN	2.77*	CAUC > AA (.47)			
PROPENSITY TO HANDOFF	1.11				
SIMPLIFY	5.05**	ASIAN > AA (.56)	OTHER > AA (.87)		
RESILIENCE	5.82**	CAUC > HISP (.57)	CAUC > AA (.50)	ASIAN > HISP (.54)	ASIAN > AA (.49)
CHANGE	1.57				
FRUSTRATION	1.75				
TEAM INCLINATION	1.47				
INDIVIDUAL INCLINATION	1.55				
SELF-MOTIVATION	3.65**	CAUC > HISP (.58)			
ROUTINE	0.33				
PROBLEM SOLVING	4.29**	CAUC > HISP (.46)	ASIAN > AA (.44)	ASIAN > HISP (.44)	

RESPONSIVENESS	5.53**	CAUC > AA (.63)	ASIAN > AA (.52)	OTHER > AA (.78)	
INNOVATION	4.06**	CAUC > AA (.59)	ASIAN > AA (.43)		
PEOPLE POSITIVE	2.45*	ASIAN > HISP (.41)			
DISCIPLINE	2.42*	CAUC > HISP (.50)			
CONFLICT HANDLING	2.70*	ASIAN > HISP (.44)			
ALTRUISM	1.73				
SELF-CONFIDENCE	4.12**	CAUC > HISP (.52)	CAUC > AA (.44)		
LEADERSHIP	5.40**	CAUC > HISP (.63)	CAUC > AA (.45)	ASIAN > HISP (.53)	
TASK EFFICIENCY	1.98				

Note. *Significant at $p < .05$. **Significant at $p < .01$. $df = 323$.

To examine mean differences for gender, an Independent Samples *t*-test was conducted for each of the 21 Shadowmatch habits. The results demonstrated that there were six habits with significant mean differences between males and females: Resilience, Change, Team Inclination, Individual Inclination, Self-Confidence, and Leadership. These differences tended to be small to medium in terms of effect size (see Table 2). Again, these types of differences in habits between groups are likely outcomes and do not necessarily mean adverse impact will be found for the Shadowmatch system.

Table 2: Mean Differences in Shadowmatch Habits for Gender

Habit	t-Value	Group Diff. (Cohen's d)
CONCEPTUAL	0.59	
PROPENSITY TO OWN	-1.43	
PROPENSITY TO HANDOFF	1.55	
SIMPLIFY	0.56	
RESILIENCE	3.05**	M > F (.34)
CHANGE	2.83**	M > F (.32)
FRUSTRATION	0.62	
TEAM INCLINATION	2.94**	M > F (.33)
INDIVIDUAL INCLINATION	-2.22**	F > M (.25)
SELF-MOTIVATION	1.75	
ROUTINE	-0.38	
PROBLEM SOLVING	1.79	
RESPONSIVENESS	0.43	
INNOVATION	-1.08	
PEOPLE POSITIVE	0.82	
DISCIPLINE	1.56	
CONFLICT HANDLING	1.07	
ALTRUISM	1.35	
SELF-CONFIDENCE	3.11**	M > F (.35)
LEADERSHIP	2.96**	M > F (.33)
TASK EFFICIENCY	0.76	

Note. *Significant at $p < .05$. **Significant at $p < .01$. $df = 326$.

A second way in which this study assesses the potential for adverse impact is through a simulated selection technique. As stated previously, this involves examining scenarios in which each participant is considered an applicant and selection decisions are made based on the Shadowmatch assessment. Specifically, five industry benchmarks were used, with each benchmark treated as the selection criterion for a given job. This allows for an exploration of adverse impact potential across five specific benchmarks. In these analyses, we analyzed adverse impact potential for three different selection ratios: .1, .3, and .5. The selection ratio indicates how many employees, out of the total number of applicants, will be hired. With 328 total applicants, the .1, .3, and .5 selection ratios resulted in hiring 33, 99, and 164 applicants, respectively. In order to determine which applicants would be hired, the "Final Recommendation" score was used. However, because there were more applicants with the same "Final Recommendation" score than would be hired with a specific selection ratio, the "Attitude Indicator" (first) and the "Critical Match" score (second) were used as tie-breakers.

Food Industry (Race)

The first benchmark was the Food Industry benchmark, which contained 9 individuals (5 females). With a selection ratio of .1, there were 33 applicants hired. Of these 33, there were 10 African-Americans, 10 Asians, 7 Caucasians, 5 Hispanics, and 1 "Others" that would be hired. Based on how many participants there were of each race in the total sample, the percentage of each race hired is as follows: Asian (13%), African American (13%), Caucasian (9%), Hispanic (7%), and Other (6%). In order to determine whether there is adverse impact in this simulation, we divided each "minority" race percentage by the "majority" race percentage, where "majority" refers to the group with the largest percentage hired (Asians and African Americans in this case) and "minority" refers to the groups with lower percentages hired. If the resulting "impact ratio" is less than 80%, then there is evidence of adverse impact. In this simulation, at the .1 selection ratio, there was evidence of adverse impact for Caucasians and Hispanics (Table 3 demonstrates these results). The *Z* test for difference in proportions indicates that the differences were not statistically significant.

When using a selection ratio of .3, there were 99 applicants hired. Of these 99, there were 22 African-Americans (28% of their total), 31 Asians (39% of their total), 24 Caucasians (31% of their total), 16 Hispanics (21% of their total), and 6 Others (38% of their total). The majority race in this simulation was Asians. The impact ratio for Caucasians was above 80%, but for African-Americans and Hispanics it was below 80%. Therefore, at a selection ratio of .3, there was evidence of adverse impact for both African-Americans and Hispanics (Table 3 demonstrates these results). However, the *Z* test for difference in proportions indicates that these differences were not statistically significant.

Lastly, we analyzed adverse impact at a selection ratio of .5, which meant that 164 applicants were hired. The hires included 40 African-Americans (50% of their total), 43 Asians (54% of their total), 39 Caucasians (51% of their total), 31 Hispanics (41% of their total), and 11 Others (69% of their total). Without counting Other as a

single race, Asians were the "majority" once again. The only impact ratio below 80% was for Hispanics, so at a .5 selection ratio, there was evidence of adverse impact only for Hispanics (Table 3 demonstrates these results). According to the *Z* test for difference in proportions, the Hispanic and Asian group difference was not statistically significant.

Table 3: Food Industry Simulated Selection (Race)

	Selection Ratio								
	.1			.3			.5		
	# Hired	% Total	Impact Ratio	# Hired	% Total	Impact Ratio	# Hired	% Total	Impact Ratio
African-American	10	13%	--	22	28%	71%	40	50%	93%
Asian	10	13%	--	31	39%	--	43	54%	--
Caucasian	7	9%	73%	24	31%	80%	39	51%	94%
Hispanic	5	7%	53%	16	21%	55%	31	41%	77%
Other	1	6%	50%	6	38%	97%	11	69%	128%

Note. Any discrepancies in the Impact Ratio calculations are due to rounding.

Food Industry Benchmark (Gender)

In order to examine the potential for adverse impact for gender, we conducted the same selection simulation as before, but compared the proportion of males hired to that of females. Once again, we used the .1, .3, and .5 selection ratios. At a .1 selection ratio, 18 males (13% of their total) and 15 females (8% of their total) were hired. This resulted in an impact ratio of 59%, which means that there is evidence of adverse impact where males are hired more often than females. We found the same result at the .3 selection ratio, where 47 males (35% of their total) and 52 females (27% of their total) were hired, which resulted in an impact ratio of 78% and demonstrated adverse impact. However, at a selection ratio of .5, 71 males (52% of their total) and 93 females (48% of their total) were hired, resulting in an impact ratio of 93% and no adverse impact. These analyses demonstrated there was evidence of adverse impact at the .1 and .3 selection ratios in regards to a person's gender (Table 4 demonstrates these results). However, according to the *Z* test for difference in proportions, neither difference in the proportion of males and females hired was statistically significant.

Table 4: Food Industry Simulated Selection (Gender)

	Selection Ratio								
	.1			.3			.5		
	# Hired	% Total	Impact Ratio	# Hired	% Total	Impact Ratio	# Hired	% Total	Impact Ratio
Male	18	13%	--	47	35%	--	71	52%	--
Female	15	8%	59%	52	27%	78%	93	48%	93%

Note. Any discrepancies in the Impact Ratio calculations are due to rounding.

High Tech Benchmark (Race)

In the High Tech benchmark, there were 9 individuals (8 females). At the .1 selection ratio, 33 applicants were "hired." Of the 33, there were 11 African-Americans (14% of their total), 11 Asians (14% of their total), 2 Caucasians (3% of their total), 5 Hispanics (7% of their total), and 4 Others (25% of their total). Once again, we analyzed the impact ratio to assess whether there is evidence of adverse impact and we did not include "Others" as a comparison race. Given that African-Americans and Asians had the largest percentage hired, they were used as the "majority." The impact ratios for both Caucasians and Hispanics were below 80%, thus providing evidence of adverse impact for those races (Table 5 demonstrates these results). According to the *Z* test for difference in proportions, neither group difference in hiring rates were statistically significant.

At the .3 selection ratio, 99 applicants were hired, which included 27 African-Americans (34% of their total), 22 Asians (28% of their total), 23 Caucasians (30% of their total), 19 Hispanics (25% of their total), and 8 Others (50% of their total). At this selection ratio, African-Americans were the majority. Only the impact ratio of Hispanics was below 80%. Therefore, we found evidence of adverse impact for Hispanics at a selection ratio of .3 (Table 5 demonstrates these results). However, according to the *Z* test for difference in proportions, the group difference between African-Americans' and Hispanics' hiring rates was not statistically significant.

Finally, we examined the .5 selection ratio which included 39 African-Americans (49% of their total), 41 Asians (51% of their total), 36 Caucasians (47% of their total), 37 Hispanics (49% of their total), and 11 Others (69% of their total), for a total of 164 participants. Asians were used as the majority, which did not result in impact ratios under 80% for any of the races. This demonstrated that there was no evidence of adverse impact at a selection ratio of .5 (Table 5 demonstrates these results).

Table 5: High Tech Simulated Selection (Race)

	Selection Ratio								
	.1			.3			.5		
	# Hired	% Total	Impact Ratio	# Hired	% Total	Impact Ratio	# Hired	% Total	Impact Ratio
African-American	11	14%	--	27	34%	--	39	49%	95%
Asian	11	14%	--	22	28%	81%	41	51%	--
Caucasian	2	3%	19%	23	30%	89%	36	47%	91%
Hispanic	5	7%	48%	19	25%	75%	37	49%	96%
Other	4	25%	182%	8	50%	148%	11	69%	134%

Note.

Any discrepancies in the Impact Ratio calculations are due to rounding.

High Tech Benchmark (Gender)

At a .1 selection ratio, 12 males (9% of their total) and 21 females (11% of their total) were hired. This resulted in an impact ratio of 81%, which is evidence that there is not adverse impact. At a .3 selection ratio, 36 males (26% of their total) and 63 females (33% of their total) were hired, which is, once again, an impact ratio of 81%. Lastly, at a selection ratio of .5 we found an impact ratio of 93%, where 65 males (48% of their total) and 99 females (52% of their total) were hired. This demonstrated there was no evidence of adverse impact for gender at any of the three selection ratios (Table 6 demonstrates these results).

Table 6: High Tech Simulated Selection (Gender)

	Selection Ratio								
	.1			.3			.5		
	# Hired	% Total	Impact Ratio	# Hired	% Total	Impact Ratio	# Hired	% Total	Impact Ratio
Male	12	9%	81%	36	26%	81%	65	48%	93%
Female	21	11%	--	63	33%	--	99	52%	--

Note.

Any discrepancies in the Impact Ratio calculations are due to rounding.

HR Consulting Benchmark (Race)

In the HR Consulting benchmark, there were 11 individuals (all females). With a .1 selection ratio, 5 African-Americans (6% of their total), 10 Asians (13% of their total), 7 Caucasians (9% of their total), 7 Hispanics (9% of their total), and 4 Others (25% of their total) were hired. With Asians as the majority, the African-American, Caucasians, and Hispanic impact ratios were all below 80%. This is evidence of adverse impact (Table 7 demonstrates these results). However, according to the *Z* test for difference in proportions, none of these group differences in hiring rates were statistically significant.

At a .3 selection ratio, the hires included 17 African-Americans (21% of their total), 25 Asians (31% of their total), 26 Caucasians (34% of their total), 23 Hispanics (31% of their total), and 8 Others (50% of their total). Caucasians were the majority, and when comparing them to the other races, we found evidence of adverse impact only for African-Americans (i.e., their impact ratio was below 80%). Table 7 demonstrates these results. However, the *Z* test for difference in proportions indicates that the difference was not statistically significant.

A .5 selection ratio resulted in hiring 30 African-Americans (38% of their total), 44 Asians (55% of their total), 44 Caucasians (57% of their total), 34 Hispanics (45% of their total), and 12 Others (75% of their total). Once again, Caucasians were the majority. However, there was only evidence of adverse impact for African-Americans and Hispanics (Table 7 demonstrates these results). The *Z* test for difference in proportions was, once again, not significant for either racial difference.

Table 7: HR Consulting Simulated Selection (Race)

	Selection Ratio								
	.1			.3			.5		
	# Hired	% Total	Impact Ratio	# Hired	% Total	Impact Ratio	# Hired	% Total	Impact Ratio
African-American	5	6%	50%	17	21%	63%	30	38%	66%
Asian	10	13%	--	25	31%	93%	44	55%	96%
Caucasian	7	9%	73%	26	34%	--	44	57%	--
Hispanic	7	9%	75%	23	31%	91%	34	45%	79%
Other	4	25%	200%	8	50%	148%	12	75%	131%

Note. Any discrepancies in the Impact Ratio calculations are due to rounding.

HR Consulting Benchmark (Gender)

With a .1 selection ratio, 16 males (12% of their total) and 17 females (9% of their total) were hired. This resulted in an impact ratio of 75%, which is evidence of adverse impact. At a .3 selection ratio, 43 males (32% of their total) and 56 females (29% of their total) were hired, which is an impact ratio of 92%, demonstrating no evidence of adverse impact. At the .5 ratio we hired 70 males (51% of their total) and 94 females (49% of their total), therefore resulting in an impact ratio of 95% and no adverse impact (Table 8 demonstrates these results). According to the *Z* test for difference in proportions, the difference in the proportion of males and females hired was not statistically significant at any of the three selection ratios.

Table 8: HR Consulting Simulated Selection (Gender)

	Selection Ratio								
	.1			.3			.5		
	# Hired	% Total	Impact Ratio	# Hired	% Total	Impact Ratio	# Hired	% Total	Impact Ratio
Male	16	12%	--	43	32%	--	70	51%	--
Female	17	9%	75%	56	29%	92%	94	49%	95%

Note.

Any discrepancies in the Impact Ratio calculations are due to rounding.

IT Industry Benchmark (Race)

In the IT Industry benchmark, there were 8 individuals (2 females). With a .1 selection ratio, 9 African-Americans (11% of their total), 8 Asians (10% of their total), 6 Caucasians (8% of their total), 6 Hispanics (8% of their total), and 4 Others (25% of their total) were hired. With African-Americans as the majority, we only found evidence of adverse impact for Caucasians and Hispanics who had impact ratios of 69% and 71%, respectively (Table 9 demonstrates these results). However, the *Z* test for difference in proportions indicates that the difference between these proportions was not statistically significant.

At a .3 selection ratio, the hires included 20 African-Americans (25% of their total), 23 Asians (29% of their total), 27 Caucasians (35% of their total), 24 Hispanics (32% of their total), and 5 Others (31% of their total). At this ratio, Caucasians were the majority, and when comparing them to the other races, we found evidence of adverse impact only for African-Americans (their impact ratio was 71%). Table 9 demonstrates these results. Once again, the *Z* test for difference in proportions indicates that the difference between Caucasians hired compared to African-Americans was not statistically significant.

A .5 selection ratio resulted in hiring 31 African-Americans (39% of their total), 45 Asians (56% of their total), 44 Caucasians (57% of their total), 33 Hispanics (44% of their total), and 11 Others (69% of their total). Caucasians were the majority at this ratio and there was evidence of adverse impact for Hispanics (impact ratio of 77%) and African-Americans (impact ratio of 68%). Table 9 demonstrates these results. The *Z* test for difference in proportions indicates that neither difference was statistically significant.

Table 9: IT Industry Simulated Selection (Race)

	Selection Ratio								
	.1			.3			.5		
	# Hired	% Total	Impact Ratio	# Hired	% Total	Impact Ratio	# Hired	% Total	Impact Ratio
African-American	9	11%	--	20	25%	71%	31	39%	68%
Asian	8	10%	89%	23	29%	82%	45	56%	98%
Caucasian	6	8%	69%	27	35%	--	44	57%	--
Hispanic	6	8%	71%	24	32%	91%	33	44%	77%
Other	4	25%	222%	5	31%	89%	11	69%	120%

Note. Any discrepancies in the Impact Ratio calculations are due to rounding.

IT Industry Benchmark (Gender)

At a .1 selection ratio, 15 males (11% of their total) and 18 females (9% of their total) were hired. This resulted in an impact ratio of 85%, which is not evidence of adverse impact. At a .3 selection ratio, 40 males (29% of their total) and 59 females (31% of their total) were hired, which is an impact ratio of 96%. Lastly, at a selection ratio of .5 we found an impact ratio of 98%, where 67 males (49% of their total) and 97 females (51% of their total) were hired. These analyses demonstrated there was no evidence of adverse impact for gender at any of the selection ratios (Table 10 demonstrates these results).

Table 10: IT Industry Simulated Selection (Gender)

	Selection Ratio								
	.1			.3			.5		
	# Hired	% Total	Impact Ratio	# Hired	% Total	Impact Ratio	# Hired	% Total	Impact Ratio
Male	15	11%	--	40	29%	96%	67	49%	98%
Female	18	9%	85%	59	31%	--	97	51%	--

Note. Any discrepancies in the Impact Ratio calculations are due to rounding.

Demographic Balance Benchmark (Race)

In the Demographic Balance benchmark, there were 11 individuals (5 females). At the .1 selection ratio, 33 applicants were "hired." Of the 33, there were 10 African-Americans (13% of their total), 6 Asians (8% of their total), 9 Caucasians (12% of their total), 6 Hispanics (8% of their total), and 2 Others (13% of their total). Once again, we analyzed the impact ratio to assess whether there is evidence of adverse impact and we did not include "Others" as a comparison race. Given that African-Americans had the largest percentage hired, they were used as the "majority." The impact ratios for both Hispanics and Asians were below 80%, thus providing evidence of adverse impact for those races (Table 11 demonstrates these results). According to the *Z* test for difference in proportions, none of the group differences in hiring rates were statistically significant.

At the .3 selection ratio, 99 applicants were hired, which included 17 African-Americans (21% of their total), 26 Asians (33% of their total), 28 Caucasians (36% of their total), 21 Hispanics (28% of their total), and 7 Others (44% of their total). At this selection ratio, Caucasians were the majority. The impact ratios of Hispanics and African-Americans were below 80%. Therefore, we found evidence of adverse impact at a selection ratio of .3 (Table 11 demonstrates these results). According to the *Z* test for difference in proportions, none of the group were statistically significant.

Finally, we examined the .5 selection ratio which included 36 African-Americans (45% of their total), 40 Asians (50% of their total), 43 Caucasians (56% of their total), 32 Hispanics (43% of their total), and 15 Others (94% of their total). Once again Caucasians were used as the majority, which resulted in impact ratios under 80% for Hispanics only which is evidence of adverse impact (Table 11 demonstrates these results). The *Z* test indicated that none of the group differences in hiring rates were statistically significant.

Table 11: Demographic Balance Benchmark Simulated Selection (Race)

	Selection Ratio								
	.1			.3			.5		
	# Hired	% Total	Impact Ratio	# Hired	% Total	Impact Ratio	# Hired	% Total	Impact Ratio
African-American	10	13%	--	17	21%	58%	36	45%	81%
Asian	6	8%	60%	26	33%	89%	40	50%	90%
Caucasian	9	12%	94%	28	36%	--	43	56%	--
Hispanic	6	8%	64%	21	28%	77%	32	43%	76%
Other	2	13%	100%	7	44%	120%	15	94%	168%

Note. Any discrepancies in the Impact Ratio calculations are due to rounding.

Demographic Balance Benchmark (Gender)

At a .1 selection ratio, 18 males (13% of their total) and 15 females (8% of their total) were hired. This resulted in an impact ratio of 59%, which is evidence of adverse impact. At a .3 selection ratio, 45 males (33% of their total) and 54 females (28% of their total) were hired, which is an impact ratio of 85% and is not evidence of adverse impact. Lastly, at a selection ratio of .5 we found an impact ratio of 91%, where 72 males (53% of their total) and 92 females (48% of their total) were hired, which is, once again, not evidence of adverse impact (Table 12 demonstrates these results). According to the *Z* test for difference in proportions, the difference in the proportion of males and females hired was not statistically significant at any of the three selection ratios.

Table 12: Demographic Balance Benchmark Simulated Selection (Gender)

	Selection Ratio								
	.1			.3			.5		
	# Hired	% Total	Impact Ratio	# Hired	% Total	Impact Ratio	# Hired	% Total	Impact Ratio
Male	18	13%	--	45	33%	--	72	53%	--
Female	15	8%	59%	54	28%	85%	92	48%	91%

Note. Any discrepancies in the Impact Ratio calculations are due to rounding.

Summary and Conclusions

This report describes research examining the potential for adverse impact associated with the use of the Shadowmatch Worksheet in selection situations. Participants in this research were 328 individuals recruited through M*Turk who were assessed on the 21 habits measured by the Shadowmatch Worksheet. To examine adverse impact potential, two sets of analyses were conducted: mean difference and selection simulation.

The mean difference analyses explored mean differences across racial and gender groups. The analyses for race indicated that 13 out of the 21 Shadowmatch habits produced a statistically significant difference in average scores for at least two racial groups. The analyses for gender indicated that 6 out of the 21 Shadowmatch habits produced statistically significant mean differences between men and women. These results are consistent with the notion that there are likely to be some mean differences in habits across demographic groups. Furthermore, because the Shadowmatch system uses a benchmark matching approach, the potential implications of mean differences for selection rate differences (i.e., for adverse impact) are less clear than for other selection approaches, particularly those involving top-down selection (where the highest scoring individuals are selected). Thus, results from the mean difference analyses should be interpreted cautiously, as any mean differences may or may not produce adverse impact given the Shadowmatch selection approach.

The selection simulation analyses explored for potential differences in selection rates across racial and gender groups. In these analyses, several selection scenarios were simulated in which participants were “hired” using an approach similar to what would be used operationally with the Shadowmatch Worksheet. Specifically, five selection scenarios were simulated involving five different benchmarks (food industry, high tech, HR consulting, IT industry, and a demographic balance benchmark). For each benchmark, “applicants” (participants) were selected based on their similarity to the benchmark at three separate selection ratios (.1, .3, and .5). Once the applicants were selected, adverse impact was then assessed using the four-fifths rule and the *Z* test for difference in proportions. Results indicated that the four-fifths rule was violated for some groups under some of the conditions examined. However, the *Z* test indicated that none of these differences were statistically significant. Thus, this indicates that there were no instances of practically and statistically significant adverse impact in the scenarios examined.

Two additional points are important to note regarding the pattern of selection simulation results. First, which group was the “majority” group (and thus which were the “minority” groups) in terms of selection rates changed across scenarios (e.g., in some cases Caucasians were the majority but in other cases Asians or African Americans were the majority). This suggests that the Shadowmatch system does not consistently produce better selection outcomes for one demographic group over others. Furthermore, the differences in results across benchmarks suggest that the makeup of the benchmark is a key factor in determining the potential for adverse impact. Second, there are potentially important differences between the circumstances involved in this study (research setting) and the circumstances that would be involved in the operational use of the Shadowmatch Worksheet in selection settings. Specifically, the participants involved in this study were research participants rather than actual job applicants and thus they did not necessarily have the characteristics and qualifications required for a specific job. Additionally, unlike applicant settings, test takers in research settings are not motivated by the prospect of a job or promotion opportunity. These differences (e.g., differences in the qualifications of those who complete the worksheet, differences in the motivation involved in completing the worksheet) likely then have implications for the generalizability of the current results to selection settings involving real applicants. For instance, mean differences and selection rate differences could be even smaller in some selection settings as a result of these differences between research and operational settings. With these caveats in mind, the overall pattern of results suggests that the Shadowmatch system does not produce clear and consistent differences across groups in terms of selection outcomes. Instead, the potential for adverse impact appears to be largely dependent upon several local factors including the selection ratio and the composition of the focal benchmark.

8. International (non-USA based) Adverse Impact Study

Analyzing the patterns in the selection of options in the Shadowmatch worksheet

Reviewed by the Center for Organizational Effectiveness at the Florida Institute of Technology

The Center for Organizational Effectiveness

Florida Institute of Technology

2013

Purpose of the study

The purpose of this study is to determine whether the utilization of the Shadowmatch worksheet in the employment process could result in adverse impact for any particular demographic group through the analysis of the interactions of a sample of individuals from different demographic groups with the Shadowmatch worksheet.

Shadowmatch background

Shadowmatch is a worksheet application that is used to determine the strength of an individual's habits. The individual is rated on 19 different habits as well as on the individual's conceptual fitness, task efficiency and attitude. The application determines the scores received by the applicant on these measures by using the input of the applicant. An applicant is then provided with what is known as a "shadow" that will indicate the habits of the individual. Habits are a very reliable way to predict the behavior of people, they have recurring patterns and these patterns can be predicted with relatively high accuracy.

It is therefore important to note that Shadowmatch does not report negative information about the individual. When a graph represents low scores on some habits, it indicates that the individual does not seem to manage that area of his/her life with behavioral patterns so strong that it can be referred to as a habit. Low habit scores can also be interpreted as planned behavior.

The behavioral pattern or "shadow" therefore presents a prospective employer with a good indication of whether an applicant will fit into the environment of the organization by comparing the habits of the applicant with the habits of the top performers within the organization. Shadowmatch is used to determine the correlation between the applicant and a benchmark developed from the top performers selected by the organization. The performance of an employee in the working environment is dependent on various factors such as fit in environment and the individual's inclination toward specific behaviors which relate to the execution of the required task (i.e., team work or task efficiency). Shadowmatch compares the habits of employees who are already successful with new applicants and provides the employer with a comprehensive matching report that indicates how strong the match is.

Relevant legislation

The following is the text of Title VII of the Civil Rights Act of 1964 (Pub. L.88-352) (Title VII):

(a) It shall be an unlawful employment practice for an employer -

(1) to fail or refuse to hire or to discharge any individual, or otherwise to discriminate against any individual with respect to his compensation, terms, conditions, or privileges of employment, because of such individual's race, color, religion, sex, or national origin; or

(2) to limit, segregate, or classify his employees or applicants for employment in any way which would deprive or tend to deprive any individual of employment opportunities or otherwise adversely affect his status as an employee, because of such individual's race, color, religion, sex, or national origin.

(b) It shall be an unlawful employment practice for an employment agency to fail or refuse to refer for employment, or otherwise to discriminate against, any individual because of his race, color, religion, sex, or national origin, or to classify or refer for employment any individual on the basis of his race, color, religion, sex, or national origin.

Defining adverse impact

After the passage of the 1964 US Civil Rights Act (commonly known as Title VII), as presented in short above, the legislative and judicial fields began defining the concept of adverse impact. After thousands of litigation cases and arbitrations the concept has been refined and expanded to apply to settings other than that for which it was first intended (e.g., using adverse impact calculations in age discrimination cases).

While no definitive explanation of what constitutes a "finding of adverse impact" has yet been determined the general meaning of the term is widely accepted: a substantially different rate of selection in hiring, promotion or other employment decision which works to the disadvantage of members of a demographic group.[6]

Adverse impact simply indicates differences between the pass rates of groups when using a certain testing process and is not a legal term that implies guilt or a psychometric term that implies unfairness or test bias. Many tests that examine relevant job skills will generate adverse impact and not normally due to forms of bias inherent to the tests as indicated by the majority of studies done on the matter (Sackett, 2001; Neisser, 1996).

The Supreme Court decision in Griggs v. Duke Power Company (1971) presented the first delineation of the concept of adverse impact: Discrimination exists when there is evidence of a statistical disparity in selection or promotion rates, unless the practice meets a business necessity. The EEOC Uniform Guidelines on Employee Selection Procedures (1978) suggested the four-fifths rule (Morris, S.B. 2001):

> *A selection rate for any race, sex, or ethnic group that is less than four-fifths (4/5 or eighty percent) of the rate for the group with the highest rate will generally be regarded by the Federal enforcement agencies as evidence of adverse impact... (Section 4D, p. 38297).*

Adverse impact assessment uses the following basic statistic in the four-fifths rule called the Impact Ratio (IR). The Impact Ratio is the ratio of the selection or pass rate for the minority group (SR_{min}) divided by the selection or pass rate for the majority group (SR_{maj}), or

$$IR = \frac{SR_{min}}{SR_{maj}}$$

[6] Biddle, D. *Adverse Impact and Test Validation – A Practitioner's Guide to Valid and Defensible Employment Testing.* Second Edition.

In order to illustrate the functionality of the four-fifths rule the following two examples are presented:

a) For example: a certain organization decides to test the literacy of applicants for a position available in the organization but soon recognizes some discrepancies in the results of different demographic groups. Upon further investigation, it is revealed that 74% of a certain demographic group passed the test while only 34% of a different demographic group passed. The Impact Ratio for this test is therefore calculated as 34/74 and equals 0.46. Since the Impact Ratio is smaller than 0.8 this test will constitute as having adverse impact.
b) For example: the organization then decides to utilize a different test in which the pass rate for the first demographic group remains 74%, but the pass rate for the second group is 60%.The Impact Ratio for this test is therefore calculated as 60/74 and equals 0.81. Since the Impact Ratio is greater than 0.8 this test will not constitute as having adverse impact.

The application of the four-fifths rule illustrates that discrepancies in the results of different demographic groups obtained from a certain employment method is not necessarily an indication of adverse impact. Evidence of adverse impact is present when the discrepancies are such that the four-fifths rule is violated. Although the four-fifths rule presents only one way of examining adverse impact, it is widely accepted and presents a simple solution in determining the adverse impact of an employment practice. In addition to the four-fifths rule, statistical significance tests are also widely used in examining adverse impact.

Research Design

The method employed in this study covers the data mining, analysis and the reporting of the results. This includes the collection and validation of data obtained from a case study, the application of the appropriate statistical methods to analyze the date, obtaining results from the statistical processes applied to the data, the analyses and interpretation of the results and the finalization and conclusion of the results.

Case study sampling

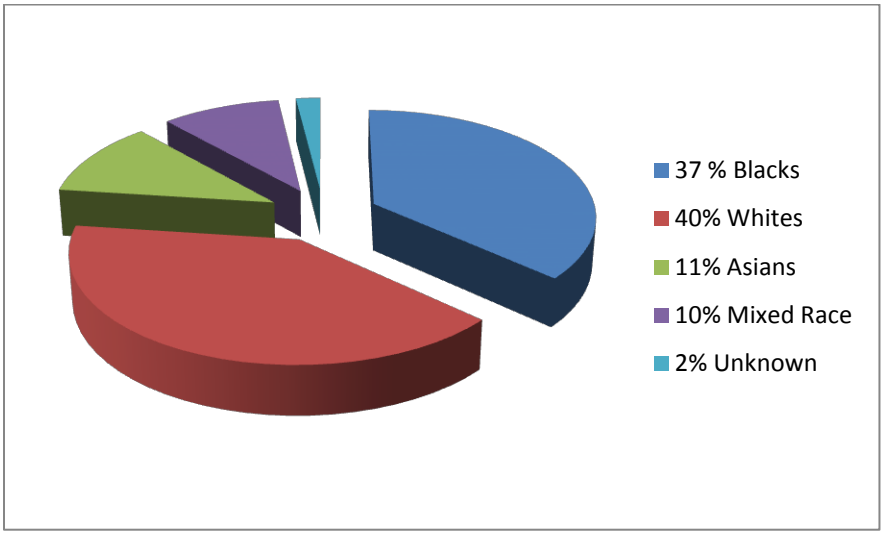
When investigating the interaction of a group of individuals with the Shadowmatch worksheet many unrelated attributes of the individuals could impact the results obtained. Factors like level of education, current employment position and socio-economic status could produce differences in results that are not related to the demographic differences in individuals. A case study of 3500 individuals working in a similar position in the same company and with similar levels of education was gathered to minimize possible external influences that could impact the results. The size of the case study employed will also ensure that the results are accurate and repeatable and prevent possible misrepresentation and statistical errors that could result from the utilization of a small sample.

Data gathering

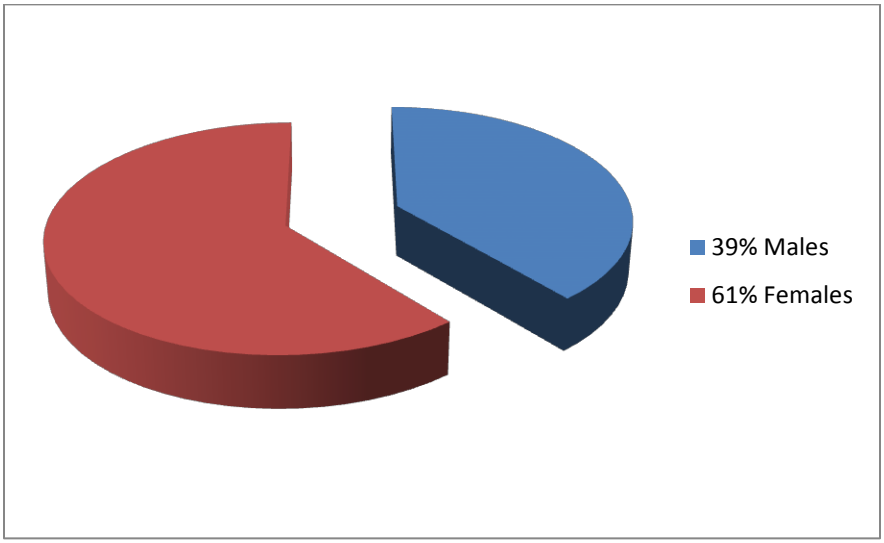
The data points for the study were provided by WesBank (a large financial institution) and feature the following attributes of the 3500 individuals who formed part of this study:

- Individual's race;
- Individual's gender;
- Individual's selections on the worksheet; and
- Individual's results or "shadow" obtained.

The sample group utilized in this study presented the following demographic characteristics based on race:



The sample group presented the following demographic characteristics based on gender:



Investigation approach

The investigation examines differences in race and gender separately and was undertaken in the three phase data analysis method presented as follows:

- Determining the effect size of possible differences between groups of individuals with different demographic attributes.
- Determining whether possible differences between groups of individuals with differences in demographic attributes could result in adverse impact.

- Determining whether historical benchmarks used in the execution of Shadowmatch would result in adverse impact based on the current case study.

Method Outline

Method 1: Determining the effect size

To determine the significance of possible variations in the answers presented and results achieved between different demographic groups the effect size of the Shadowmatch results were investigated. These calculations provide a useful indication whether the Shadowmatch worksheet would be prone to generate variations in the results of different demographic groups. These results cannot however prove or disprove adverse impact.

Method description

Partial eta^2 can be defined as the ratio of variance accounted for by an effect and that effect plus its associated error variance within an analysis of variance (ANOVA) study (see Tabachnick & Fidell, 2001, pp. 54-55, and Thompson, 2006, pp. 317-319). Formulaically, partial eta², or η², is defined as follows:

$$\text{Partial } \eta^2 = \frac{SS_{effect}}{SS_{effect} + SS_{error}}$$

- SS_{effect} = the sums of squares for whatever effect is of interest
- SS_{error} = The sum of squared deviation for the error term associated with this main effect or interaction

Partial eta²	Value
0.01	Small
0.06	Medium
0.14	Large

1) Sample description

Race	Value Label	N
1	Black	1016
2	White/Caucasian	1121
3	Asian	314
4	Mixed Race	269
5	Unknown/Control	55

Method results

The eta² of race as an effect in the variation between the scores achieved for each demographic group in comparison to the others was calculated to investigate the scale and significance of possible variations in the score achieved. The full results are presented as follows.

DESIGNATION	BLACK	WHITE	ASIAN	MIXED RACE	UNKNOWN	TOTAL
Measure	**Mean**	**Mean**	**Mean**	**Mean**	**Mean**	**Mean**
Time Total	3077.99	2595.91	2629.43	2756.75	2686.51	2793.59
Conceptual Questions	4.66	5.49	5.26	5.05	5.03	5.13
Propensity to Own	41.31	46.18	45.22	44.46	46.98	44.14
Propensity to Hand-off	34.03	31.19	31.89	32.07	30.53	32.38
To Simplify	35.80	43.49	41.50	40.58	45.85	40.21
Resilience	41.21	46.53	45.98	43.59	48.44	44.27
Propensity to Change	31.79	35.00	34.68	33.75	37.31	33.71
Frustration	38.31	41.65	42.59	41.16	42.29	40.50
Team Inclination	47.83	45.18	46.90	45.59	47.84	46.44
Individual Inclination	27.72	30.28	28.66	29.49	28.33	29.04
Self-motivation	38.28	41.84	41.41	40.47	43.29	40.38
Routine	36.91	37.96	38.49	38.21	35.91	37.62
Problem Solving	39.80	44.39	43.51	42.03	46.76	42.43
Responsiveness	42.31	51.12	48.87	48.17	53.82	47.41
Innovation	31.52	38.84	36.86	36.62	41.53	35.77
People Positive	43.69	43.62	45.38	44.24	46.24	43.96
Discipline	47.37	48.88	49.64	48.79	50.60	48.44
Conflict Handling	45.44	45.61	46.47	45.56	45.62	45.64
Altruism	43.90	41.51	44.04	42.40	46.07	42.85
Self Confidence	42.63	47.90	46.48	45.33	48.95	45.58
Leadership	41.81	44.66	44.39	43.27	46.24	43.48
Task Efficiency	39.15	46.54	45.67	42.81	44.75	43.34
a1	42.39	46.23	45.67	44.58	48.24	44.64
a2	30.01	28.60	28.88	28.45	28.25	29.13
a3	16.47	15.14	15.58	15.73	14.73	15.73
a4	19.00	20.09	19.01	19.69	18.15	19.49

DESIGNATION	BLACK	WHITE	ASIAN	MIXED RACE	UNKNOWN	TOTAL
Measure	**Std Dev**	**Std Dev**	**Std Dev**	**Std Dev**	**Std Dev**	**Std Dev**
Time Total	1605.189	1163.839	1107.065	1304.752	937.204	1363.213
Conceptual Questions	1.736	1.831	1.836	1.919	1.773	1.845
Propensity to Own	7.759	7.593	7.619	7.586	7.966	7.972
Propensity to Hand-off	7.116	7.288	7.573	7.272	7.503	7.371
To Simplify	11.114	10.958	10.873	11.791	11.814	11.839
Resilience	12.064	11.477	12.592	11.955	12.784	12.146
Propensity to Change	11.044	11.131	11.332	11.397	10.803	11.241
Frustration	11.344	11.206	12.302	12.136	12.043	11.611
Team Inclination	10.879	10.301	10.632	10.518	10.638	10.643
Individual Inclination	8.448	8.100	7.772	8.011	7.817	8.253
Self-motivation	9.952	9.318	9.758	9.897	10.609	9.821
Routine	9.612	10.097	9.824	9.582	10.160	9.856
Problem Solving	9.506	9.412	9.963	9.902	10.484	9.811
Responsiveness	11.017	11.074	10.926	11.829	12.161	11.832
Innovation	9.826	10.850	10.429	11.066	11.192	10.985
People Positive	11.024	11.263	12.154	11.129	12.029	11.294
Discipline	9.936	9.310	9.825	9.714	11.196	9.712
Conflict Handling	11.337	11.332	11.934	11.276	11.968	11.407
Altruism	13.215	12.818	13.518	13.043	14.043	13.139
Self Confidence	11.151	11.514	11.961	11.404	11.123	11.655
Leadership	7.809	7.497	7.956	7.784	8.235	7.820
Task Efficiency	13.788	15.406	16.198	14.161	15.773	15.181
a1	9.591	9.558	10.385	9.516	9.487	9.882
a2	7.754	7.601	7.577	7.377	7.582	7.658
a3	6.767	6.289	6.164	6.661	6.026	6.509
a4	6.920	7.349	7.165	7.245	5.967	7.154

Measure	Partial Eta Squared	Statistical Significance
Time Total	0.026	0.000
Conceptual Questions	0.044	0.000
Propensity to Own	0.077	0.000
Propensity to Hand-off	0.031	0.000
To Simplify	0.091	0.000
Resilience	0.042	0.000
Propensity to Change	0.019	0.000
Frustration	0.021	0.000
Team Inclination	0.013	0.000
Individual Inclination	0.019	0.000
Self-motivation	0.029	0.000
Routine	0.004	0.019
Problem Solving	0.048	0.000
Responsiveness	0.116	0.000
Innovation	0.093	0.000
People Positive	0.003	0.059
Discipline	0.008	0.000
Conflict Handling	0.001	0.737
Altruism	0.009	0.000
Self Confidence	0.042	0.000
Leadership	0.030	0.000
Task Efficiency	0.049	0.000
a1	0.034	0.000
a2	0.008	0.000
a3	0.009	0.000
a4	0.006	0.003

Male vs. Female

DESIGNATION	MALE		FEMALE			
Measure	**Mean**	**Std Dev**	**Mean**	**Std Dev**	**Partial Eta²**	**Significance**
Time Total	2948.65	1693.486	2697.16	1091.138	0.008	0.000
Conceptual Questions	5.562	1.850	4.82	1.772	0.045	0.000
Propensity to Own	45.84	7.572	43.06	8.026	0.029	0.000
Propensity to Hand-off	30.88	6.924	33.34	7.484	0.026	0.000
To Simplify	43.95	11.436	37.84	11.136	0.066	0.000
Resilience	48.58	11.403	41.54	11.826	0.080	0.000
Propensity to Change	37.32	10.995	31.42	10.786	0.065	0.000
Frustration	41.74	11.670	39.70	11.503	0.007	0.000
Team Inclination	47.43	11.314	45.80	10.168	0.006	0.000
Individual Inclination	28.55	8.435	29.35	8.118	0.002	0.012
Self-motivation	43.89	9.404	38.15	9.428	0.081	0.000
Routine	36.53	9.687	38.30	9.901	0.008	0.000
Problem Solving	46.04	9.413	40.13	9.374	0.086	0.000
Responsiveness	51.31	11.226	44.93	11.540	0.069	0.000
Innovation	38.63	10.779	33.95	10.734	0.043	0.000
People Positive	44.50	11.738	43.61	10.996	0.001	0.043
Discipline	51.07	9.369	46.76	9.576	0.047	0.000
Conflict Handling	46.26	11.713	45.24	11.182	0.002	0.022
Altruism	42.69	13.142	42.94	13.139	0.000	0.629
Self Confidence	50.40	10.841	42.53	11.128	0.108	0.000
Leadership	46.53	7.481	41.55	7.424	0.096	0.000
Task Efficiency	42.92	15.262	43.57	15.120	0.000	0.267
a1	47.31	9.599	42.95	9.599	0.047	0.000
a2	30.73	7.594	28.10	7.525	0.028	0.000
a3	14.48	5.950	16.53	6.720	0.024	0.000
a4	17.40	6.511	20.83	7.235	0.054	0.000

Interpreting the results

When considering the results that indicate relationships between demographic attributes and expected outcomes previous research conducted on this topic should be taken into account. Based on the research conducted in 1997 on United States working adults at the University of Oregon[7] mean differences ranging from 0.05 to 0.20 were found between genders and mean differences ranging from 0.01 to 0.23 were found between different racial/ethnic groups. These findings indicate that it should be expected to find correlations in the results as there are inherent personality and behavioral differences between demographic groups. These results show that there are mean differences between different demographic groups on personality tests.

The findings from this paper do indicate some statistically significant relationships and some non-significant relationships that coincide with other research conducted. The aim however of this document is not to focus on correlations between demographic groups and their measured habits; it is to determine whether the use of Shadowmatch might result in adverse impact if used as a selection tool.

Method findings

The analysis of all the possible sources of variation in the results presented the following key findings.

1. The partial eta² of the variation in the Shadowmatch scores across different demographic groups is statistically significant for the majority of cases; however, the variation as defined by eta is relatively small.

2. Based on the analysis performed there is an overall small to medium partial eta² identified. The habits that do indicate statistical significance are not specific to a single demographic group. Findings indicated that the results are not consistently higher or lower for one demographic group.

3. This test does conform to the expected results as concluded based on researched differences between demographic groups. This is presented in the statistically significant relationships between some habits and specific demographic groups. However, as a whole the results do not indicate that there is enough consistency in the correlations to indicate that Shadowmatch is inherently constructed to cause adverse impact.

4. Shadowmatch scores applicants based on the match with a selected benchmark. The match is calculated by a weighted contribution, and the way that the habits contribute to the final score results in a contribution per habit match towards the final match as low as 1%. Attitude, conceptual, task efficiency and time are more important.

[7] L.R. Goldberg, D Sweeney, P.F. Merenda and J.E. Hughes (1997) *Demographic variables and personality: The effects of gender, age, education, and Ethnic/racial status on self-descriptions of personality attributes.* University of Oregon

Method 2: Testing for adverse impact

Should statistically significant mean differences be found an adverse impact assessment will be required to examine the results for adverse impact, as defined by law, more directly.

Method description

The process of determining whether Shadowmatch could create adverse impact is complicated in that Shadowmatch has no obvious pass and fail score, but merely presents the most likely way an applicant will react in certain situations. In order to determine whether this could result in adverse impact for a specific demographic group an investigation of the variation in the habits of the different demographic groups was undertaken.

The test will therefore calculate the pass rates for each individual demographic group based on a benchmark calculated from the average score achieved by the full representative sample and a benchmark calculated from the average score achieved by white and male individuals to determine the effect that a benchmark with built-in bias would have on the final "pass" rate. The investigation involved the utilization of the impact ratio, as it is the basic guideline for organizations to ensure their compliance with the four-fifths rule suggested by the EEOC Uniform Guidelines on Employee Selection Procedures (1978).

In order to ensure compliance with the US Civil Rights legislation the four-fifths rule was applied to the results obtained from the Shadowmatch worksheet. In order to gain a recommendation (pass) from the Shadowmatch worksheet the individual needs to gain a pass mark on four distinctive factors that each carries the same weight. The factors and relevant pass rates are presented below:

1) Whether an individual falls within a 9% margin of the benchmark on each habit;
    - The percentage of each demographic group that falls within the aforementioned bracket will be calculated as the pass rate per habit.
    - The Impact Ratio for each habit and the overall habit recommendation is calculated based on the pass rates of different demographic groups.
2) Whether an individual scores within two points of the benchmark conceptual question score;
    - The percentage of each demographic group that falls within the aforementioned bracket will be calculated as the pass rate for conceptual fitness
    - The Impact Ratio is calculated based on the pass rates of different demographic groups.

3) Whether an individual shows a time efficiency within a 90% ratio of the benchmark;

    - The percentage of each demographic group that results in a ratio greater than 90% when the benchmark score and the score of the individual is compared is calculated as the pass rate for each demographic group.

    - The Impact Ratio is calculated based on the pass rates of different demographic groups.

4) Whether an individual falls in the same attitude quadrant (pass) or adjacent quadrant (undetermined: This will not be a fail but the system will caution the user as to the fact that it is not a perfect match) as the benchmark.

    - The percentage of individuals that fall in the same quadrant or adjacent quadrant as the benchmark is calculated as the pass rate.

    - The Impact Ratio is calculated based on the pass rates of different demographic groups.

Each of these calculations will be repeated for two benchmarks: 1) A benchmark representative of the sample based on the global average; 2) A benchmark based on the average score achieved by white and male individuals. Through the application of this methodology, the investigation aims to establish whether the scores achieved by individuals from different demographic groups differ to such an extent as to create adverse impact. Should the result of the impact ratio calculated in this investigation therefore be greater than 80% it indicates that the differences in scores achieved by different demographic groups is not significant enough to cause adverse impact.

Method results

In order to test for adverse impact the lowest possible ratio between the various pass rates achieved by individuals from different demographic groups was calculated, as well as the Impact Ratio for the final pass rates of different demographic groups based on two different benchmarks set at the global average and the average for white and male individuals.

The results displayed below are calculated by investigating the “worst case” scenario. The approach taken was to calculate the theoretical selection (percentage match to global benchmark and percentage match to bias white male benchmark) and to compare the minimum match to; Habits, conceptual, Task efficiency and quadrant match and the maximum match to the above-mentioned dimensions. The lowest match (theoretical selection) and the highest match for each biographical group are then used to calculate impact ratio. This approach is designed to investigate extreme cases to determine the probability of adverse impact towards specific demographic groups.

The minimum impact ratio for the habit match to the benchmark is based on the average of the minimum ratio possible for each habit individually and is therefore lower than the impact ratio calculated from the average

habit score. The impact ratio measure with the average benchmark as well as a white male bias benchmark showed that with these two benchmarks and using the four-fifths rules adverse impact will be rare.

Global average benchmark

Impact score	Black pass rate	White pass rate	Asian pass rate	Mixed race pass	Adverse[8] impact ratio
Habit match	61%	63%	61%	62%	0.9489
Conceptual match	73%	72%	72%	70%	0.9571
Task Efficiency match	24%	22%	21%	24%	0.8690
Quadrant match	62%	66%	64%	64%	0.9448
Average Adverse Impact Ratio					0.9224

Impact score	Male pass rate	Female pass rate	Adverse impact ratio
Habit match	61%	62%	0.9721
Conceptual match	70%	73%	0.9589
Task Efficiency match	22%	23%	0.9908
Quadrant match	63%	64%	0.9832
Average Minimum Impact Ratio			0.9728

White and male average benchmark

Impact score	Black pass	White pass rate	Asian pass rate	Mixed race pass	Adverse impact ratio
Habit match	59%	63%	61%	62%	0.9133
Conceptual match	70%	73%	72%	69%	0.9515
Task Efficiency match	23%	24%	24%	25%	0.9064
Quadrant match	61%	65%	61%	65%	0.9382
Average Minimum Impact Ratio					0.9313

Impact score	Male pass	Female pass rate	Adverse impact ratio
Habit match	63%	59%	0.9168
Conceptual match	72%	69%	0.9626
Task Efficiency match	24%	24%	0.9919
Quadrant match	65%	60%	0.9267

[8] The actual impact ratio is calculated by comparing the highest pass rate by any demographic group with the lowest pass rate of any demographic group.

Impact score	Black pass	White pass rate	Asian pass rate	Mixed race pass	Adverse impact ratio
Average Minimum Impact Ratio			0.9490		

Method findings

In order to determine whether the Shadowmatch worksheet could possibly generate adverse impact for a certain demographic group this report has undertaken extensive analysis of the data generated by comparing the Shadowmatch interaction of a number of individuals from a case study. The investigation has presented the following key findings:

1. The impact ratio for all habits measured on the worksheet was above 0.8 in all cases and presents an average impact ratio of that is consistently above 0.9 for all demographic differences tested.

2. This test indicates that not only does Shadowmatch as a whole not generate an impact ratio lower than 0.8 each individual component of the worksheet also generates an impact ratio within the required limits.

Method 3: Compensating for historic benchmarks

When testing for adverse impact in the Shadowmatch worksheet on any specific group the main challenge is the great uncertainty that remains with regards to the selection of benchmarks. As presented earlier the Shadowmatch worksheet determines whether an individual would be a suitable candidate for an employment position by matching the individual to a benchmark based on the current best performers in similar positions in the organization. This benchmark can therefore be selected at various different points within the guidelines provided by Shadowmatch.

This document has already demonstrated that given an average representative or purposefully biased benchmark the Shadowmatch worksheet will not generate any adverse impact. However, the likelihood of the average and biased benchmarks occurring in practice has not been taken into account. Method 3 will therefore attempt to determine whether adverse impact is generated from the historic benchmarks on the Shadowmatch system.

Method description

This method will calculate the pass rates for each individual demographic group based on each existing historic benchmark in the Shadowmatch database and present the average likelihood that each demographic group would pass all historic benchmarks implemented by Shadowmatch. These pass rates for different demographic groups will then be evaluated using the impact ratio as it is the basic guideline for organizations to ensure their

compliance with the four-fifths rule suggested by the EEOC Uniform Guidelines on Employee Selection Procedures (1978).

In order to ensure compliance with the US Civil Rights legislation the four-fifths rule was applied to the results obtained from the Shadowmatch worksheet. Individuals will gain a pass in the same fashion as the calculation presented in Method 2. This calculation is repeated for each demographic group on the average of the 105 historic benchmarks to gain an average pass rate for each demographic group while taking the standard deviation of the demographic group and the benchmark into account. Through the application of this methodology, the investigation aims to establish whether the scores achieved by individuals from different demographic groups differ to such an extent as to create adverse impact. Should the result of the impact ratio calculated in this investigation therefore be greater than 80% it indicates that the differences in scores achieved by different demographic groups is not significant enough to cause adverse impact.

Method results

In order to test for adverse impact the lowest possible ratio between the various pass rates achieved by different demographic groups is reported as the minimum Impact Ratio. The results are presented as follows:

	Black Pass Rate	White Pass Rate	Mixed race Pass Rate	Asian Pass Rate	Adverse Impact
Propensity to Own	0.8360	0.8935	0.8935	0.8922	0.9356
Propensity to Hand off	0.8036	0.8373	0.8164	0.8316	0.9598
To Simplify	0.8315	0.8680	0.8802	0.8489	0.9446
Resilience	0.7237	0.8258	0.7819	0.7726	0.8764
Propensity to Change	0.7969	0.8082	0.8003	0.7963	0.9853
Frustration	0.7590	0.8167	0.7855	0.7784	0.9293
Team Inclination	0.8222	0.8254	0.8283	0.8218	0.9921
Individual Inclination	0.7608	0.7534	0.7942	0.7712	0.9486
Self-motivation	0.7958	0.8585	0.8383	0.8263	0.9269
Routine	0.8249	0.8145	0.8293	0.8381	0.9718
Problem Solving	0.8290	0.8834	0.8588	0.8490	0.9383
Responsiveness	0.8208	0.8729	0.8860	0.8551	0.9264
Innovation	0.7811	0.7759	0.8051	0.7786	0.9637
People Positive	0.8375	0.8283	0.8086	0.8391	0.9635
Discipline	0.8190	0.8661	0.8556	0.8498	0.9456

Conflict Handling	0.8313	0.8332	0.8193	0.8346	0.9816
Altruism	0.8290	0.8165	0.8207	0.8206	0.9849
Self Confidence	0.7624	0.7882	0.7696	0.7854	0.9672
Leadership	0.8198	0.8781	0.8536	0.8492	0.9336
Task Efficiency	0.7761	0.7454	0.7254	0.7896	0.9187

	Male Pass Rate	Female Pass Rate	Adverse Impact
Propensity to Own	89.56%	85.76%	0.9576
Propensity to Hand off	85.91%	80.04%	0.9317
To Simplify	84.81%	85.66%	0.9901
Resilience	83.93%	73.74%	0.8785
Propensity to Change	80.11%	80.28%	0.9979
Frustration	80.11%	77.98%	0.9735
Team Inclination	80.40%	83.76%	0.9599
Individual Inclination	75.80%	76.73%	0.9878
Self-motivation	85.10%	81.38%	0.9563
Routine	81.70%	82.51%	0.9902
Problem Solving	88.09%	84.03%	0.9539
Responsiveness	86.65%	84.39%	0.9739
Innovation	78.08%	78.13%	0.9994
People Positive	81.88%	83.77%	0.9774
Discipline	88.37%	81.95%	0.9274
Conflict Handling	82.56%	83.45%	0.9893
Altruism	82.08%	82.33%	0.9970
Self Confidence	79.92%	76.17%	0.9530
Leadership	87.95%	83.05%	0.9443
Task Efficiency	75.53%	76.06%	0.9930

Method findings

In order to determine whether the Shadowmatch worksheet could possibly generate adverse impact for a certain demographic group this report has undertaken extensive analysis of the data generated by comparing the pass rates of different demographic groups. The investigation has presented the following key findings:

1. The impact ratio for all habits measured on the worksheet was above 0.8 in all cases and presents an average impact ratio of that is consistently above 0.9 for all demographic differences tested.

2. This test indicates that not only does Shadowmatch as a whole not generate an impact ratio lower than 0.8 each individual component of the worksheet also generates an impact ratio within the required limits.

Conclusion

The aim of this study was to demonstrate that the utilization of the Shadowmatch worksheet would not result in adverse impact toward any particular demographic group. In order to accomplish the specified aim the study investigated the following:

Firstly, the investigation of the effect size of the variation in scores achieved by different demographic groups indicated that statistically significant correlations were found between different demographic groups and the habits scores achieved. The correlations did however result in relatively small effect sizes. Taking into account the tolerance that Shadowmatch provides for variation in results this finding suggests that adverse impact may not be a significant issue when using the Shadowmatch worksheet; however, further analyses of the selection ratios would be helpful in directly addressing the concerns related to adverse impact.

The investigation of the expected pass rates of different demographic groups indicated that for the case study no adverse impact is found when using an average or biased benchmark from the case study or when applying all the historic benchmarks on the Shadowmatch database. This result indicates that it is statistically unlikely that the Shadowmatch worksheet would generate a variance in selection rates based on demographic groups to such an extent that adverse impact is created.

It can therefore be concluded that the utilization of the Shadowmatch worksheet will not be likely to result in adverse impact against any demographic group when applying the four-fifths rule to the results of the Shadowmatch worksheet.

Appendix A – Unlawful employment practices

42 U.S.C. § 2000e-2 (k)

(k) Burden of proof in disparate impact cases

(1)

(A) An unlawful employment practice based on disparate impact is established under this subchapter only if—

(i) a complaining party demonstrates that a respondent uses a particular employment practice that causes a disparate impact on the basis of race, color, religion, sex, or national origin and the respondent fails to demonstrate that the challenged practice is job related for the position in question and consistent with business necessity; or

(ii) the complaining party makes the demonstration described in subparagraph (C) with respect to an alternative employment practice and the respondent refuses to adopt such alternative employment practice.

(B)

(i) With respect to demonstrating that a particular employment practice causes a disparate impact as described in subparagraph (A)(i), the complaining party shall demonstrate that each particular challenged employment practice causes a disparate impact, except that if the complaining party can demonstrate to the court that the elements of a respondent's decision-making process are not capable of separation for analysis, the decision-making process may be analyzed as one employment practice.

(ii) If the respondent demonstrates that a specific employment practice does not cause the disparate impact, the respondent shall not be required to demonstrate that such practice is required by business necessity.

(C) The demonstration referred to by subparagraph (A)(ii) shall be in accordance with the law as it existed on June 4, 1989, with respect to the concept of "alternative employment practice".

(2) A demonstration that an employment practice is required by business necessity may not be used as a defense against a claim of intentional discrimination under this subchapter.

(3) Notwithstanding any other provision of this subchapter, a rule barring the employment of an individual who currently and knowingly uses or possesses a controlled substance, as defined in schedules I and II of section 102(6) of the Controlled Substances Act (21 U.S.C. 802 (6)), other than the use or possession of a drug taken under the supervision of a licensed health care professional, or any other use or possession authorized by the Controlled Substances Act [21 U.S.C. 801 et seq.] or any other provision of Federal law, shall be considered an unlawful employment practice under this subchapter only if such rule is adopted or applied with an intent to discriminate because of race, color, religion, sex, or national origin.

Appendix B – Conformation to EEO Laws

Number	Governing EEO Laws	Shadowmatch response
1	Title VII prohibits employment discrimination based on race, color, religion, sex, or national origin.	Shadowmatch as an application does not have any mechanism to determine the race, color, religion, sex, or national origin of an applicant
2	With respect to tests in particular, Title VII permits employment tests as long as they are not "designed, intended or used to discriminate because of race, color, religion, sex or national origin." 42 U.S.C. § 2000e-2(h). Title VII also imposes restrictions on how to score tests. Employers are not permitted to (1) adjust the scores of, (2) use different cutoff scores for, or (3) otherwise alter the results of employment-related tests on the basis of race, color, religion, sex, or national origin. *Id*. at §2000e-2(l).	Shadowmatch results cannot be changed or edited by anyone. All applicants will be compared to the same benchmark selected for the position.
3	Title VII prohibits **intentional** discrimination based on race, color, religion, sex, or national origin. For example, Title VII forbids a covered employer from testing the reading ability of African American applicants or employees but not testing the reading ability of their white counterparts. This is called **"disparate treatment"** discrimination. Disparate treatment cases typically involve the following issues:	Shadowmatch must be used on all the applicants to ensure that the most suitable applicant can be identified.
4	Were people of a different race, color, religion, sex, or national origin treated differently?	Shadowmatch follows an automated process to score applicants and present results to the applicable person this eliminates the possibility that Shadowmatch may be responsible for disparate treatment
5	Is there any evidence of bias, such as discriminatory statements?	All the statements generated by Shadowmatch are positive and aimed at being uplifting. Shadowmatch does not score applicants on capabilities but identifies possible behavioral trends of the individual. As proven in the results, this is not correlated to demographic attributes.

Number	Governing EEO Laws	Shadowmatch response
6	Title VII also prohibits employers from using neutral tests or selection procedures that have the **effect** of disproportionately excluding persons based on race, color, religion, sex, or national origin, where the tests or selection procedures are not "job-related and consistent with business necessity." This is called **"disparate impact"** discrimination.	Shadowmatch aims at identifying applicants with the same behavior trends as the top performers thus being directly related to the business necessity.
7	Does the employer use a particular employment practice that has a **disparate impact** on the basis of race, color, religion, sex, or national origin? For example, if an employer requires that all applicants pass a physical agility test, does the test disproportionately screen out women? Determining whether a test or other selection procedure has a disparate impact on a particular group ordinarily requires a statistical analysis.	Statistical analysis has been undertaken to determine whether Shadowmatch has a disparate impact and the results based on the four-fifths rule concluded that there is no disparate impact. Shadowmatch forms only a part of the employment process known as assisting employment selection. The rest of the employment practice must be seen as independent of Shadowmatch.
8	If the selection procedure has a disparate impact based on race, color, religion, sex, or national origin, can the employer show that the selection **procedure is job-related and consistent with business necessity**? An employer can meet this standard by showing that it is necessary to the safe and efficient performance of the job. The challenged policy or practice should therefore be associated with the skills needed to perform the job successfully. In contrast to a general measurement of applicants' or employees' skills, the challenged policy or practice must evaluate an individual's skills as related to the particular job in question.	By definition business necessity must be consistent with other employment decisions in the business thus Shadowmatch is a consistent non discriminating mechanism to identify employees most likely to prosper in the environment presented by the employment opportunity and has shown direct evidence of job relatedness.
9	See 42 U.S.C. § 2000e-2 (k). This method of analysis is consistent with the seminal Supreme Court decision about disparate impact discrimination, *Griggs v. Duke Power Co.*, 401 U.S. 424 (1971).	The analysis done in this paper is consistent with the Griggs v. Duke Power Co. Decision.

9. Job Relatedness Study

Analyzing the correlation between the ability of employees to perform their job successfully and their Shadowmatch result

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Reviewed by the Center for Organizational Effectiveness at the Florida Institute of Technology

The Center for Organizational Effectiveness

Florida Institute of Technology

2013

Purpose of the study

The purpose of this study is to determine whether the utilization of the Shadowmatch worksheet in the employment process can be directly correlated to the job performance of the applicants in the process. This is done in order to determine whether any possible adverse impact generated through the application of the Shadowmatch worksheet is based on discrimination or work requirements. In the latter case, the variance in the selection rate of different biographical groups cannot be considered an adverse impact.

Shadowmatch background

Shadowmatch is a worksheet application that is used to determine the strength of an individual's habits. The individual is rated on 19 different habits as well as on the individual's conceptual fitness, task efficiency and attitude. The application determines the scores received by the applicant on these measures by using the input of the applicant. An applicant is then provided with what is known as a "shadow" that will indicate the habits of the individual. Habits are a very reliable way to predict the behavior of people, they have recurrence patterns and these patterns can be predicted with relative high accuracy.

It is therefore important to note that Shadowmatch does not publish negative information about the individual. When a graph represents low scores on some habits, it indicates that the individual does not seem to manage that area of his/her life with behavioral patterns so strong that it can be referred to as a habit. The behavioral pattern or "shadow" therefore presents a prospective employer with a good indication of whether an applicant will fit into the environment of the organization by comparing the habits of the applicant with the habits of the top performers within the organization. Shadowmatch is used to determine the correlation between the applicant and a benchmark developed from the top performers selected by the organization.

Relevant legislation

Title VII of the Act, codified as Subchapter VI of Chapter 21 of title 42 of the United States Code, prohibits discrimination by covered employers on the basis of race, color, religion, sex or national origin (see 42 U.S.C. § 2000e-2[35]). Title VII applies to and covers an employer "who has fifteen (15) or more employees for each working day in each of twenty or more calendar weeks in the current or preceding calendar year" as written in the Definitions section under 42 U.S.C. §2000e(b). The Act does not apply to employers with 14 employees or less. Title VII also prohibits discrimination against an individual because of his or her association with another individual of a particular race, color, religion, sex, or national origin. An employer cannot discriminate against a person because of his interracial association with another, such as by an interracial marriage.

In very narrowly defined situations, an employer is permitted to discriminate on the basis of a protected trait where the trait is a bona fide occupational qualification (BFOQ) reasonably necessary to the normal operation of that particular business or enterprise. To prove the bona fide occupational qualifications defense, an employer must prove three elements: a direct relationship between the protected trait and the ability to perform the

duties of the job, the BFOQ relates to the "essence" or "central mission of the employer's business," and there is no less-restrictive or reasonable alternative (United Automobile Workers v. Johnson Controls, Inc., 499 U.S. 187 (1991) 111 S.Ct. 1196). The Bona Fide Occupational Qualification exception is an extremely narrow exception to the general prohibition of discrimination based on protected traits (Dothard v. Rawlinson, 433 U.S. 321 (1977) 97 S.Ct. 2720). An employer or customer's preference for an individual of a particular religion is not sufficient to establish a Bona Fide Occupational Qualification (Equal Employment Opportunity Commission v. Kamehameha School — Bishop Estate, 990 F.2d 458 (9th Cir. 1993)).

Title VII allows for any employer, labor organization, joint labor-management committee, or employment agency to bypass the "unlawful employment practice" for any person involved with the Communist Party of the United States or of any other organization required to register as a Communist-action or Communist-front organization by final order of the Subversive Activities Control Board pursuant to the Subversive Activities Control Act of 1950.

There are partial and whole exceptions to Title VII for four types of employers:

- Federal government; (Comment: The proscriptions against employment discrimination under Title VII are now applicable to the federal government under 42 U.S.C. Section 2000e-16)
- Federally recognized Native American tribes
- Religious groups performing work connected to the group's activities, including associated education institutions;
- Bona fide nonprofit private membership organizations

The Equal Employment Opportunity Commission (EEOC) as well as certain state fair employment practices agencies (FEPAs) enforce Title VII (see 42 U.S.C. § 2000e-4). The EEOC and state FEPAs investigate, mediate, and may file lawsuits on behalf of employees. Where a state law is contradicted by a federal law, it is over-ridden. Every state, except Arkansas and Mississippi, maintains a state FEPA (see EEOC and state FEPA directory). Title VII also provides that an individual can bring a private lawsuit. An individual must file a complaint of discrimination with the EEOC within 180 days of learning of the discrimination or the individual may lose the right to file a lawsuit. Title VII only applies to employers who employ 15 or more employees for 20 or more weeks in the current or preceding calendar year (42 U.S.C. § 2000e(b)).

In the late 1970s, courts began holding that sexual harassment is also prohibited under the Act. Chrapliwy v. Uniroyal is a notable Title VII case relating to sexual harassment that was decided in favor of the plaintiffs. In 1986 the Supreme Court held in Meritor Savings Bank v. Vinson, 477 U.S. 57 (1986), that sexual harassment is sex discrimination and is prohibited by Title VII. Same-sex sexual harassment has also been held in a unanimous decision written by Justice Scalia to be prohibited by Title VII (Oncale v. Sundowner Offshore Services, Inc., 523 U.S. 75 (1998), 118 S.Ct. 998). Title VII has been supplemented with legislation prohibiting pregnancy, age, and disability discrimination (See Pregnancy Discrimination Act of 1978, Age Discrimination in Employment Act, Americans with Disabilities Act of 1990).

In 2012, the EEOC ruled that employment discrimination on the basis of gender identity or transgender status is prohibited under Title VII.

Defining adverse impact

Not long after the passage of the 1964 US Civil Rights Act (commonly known as Title VII), the legislative and judicial fields began hammering out the concept of adverse impact. Now, 40 years later, after thousands of litigation cases and arbitrations and well over one billion US dollars spent by employers, government enforcement agencies, special interest plaintiff groups, and law firms, the concept has been highly refined. It has also expanded to apply to settings other than that for which it was first designed (e.g., some US circuit courts have recently approved of using adverse impact calculations for age discrimination cases).

While the courts still struggle for a definitive explanation of what constitutes a "finding of adverse impact," the term started out and has ended up today with much the same meaning: a substantially different rate of selection in hiring, promotion or other employment decision which works to the disadvantage of members of a race, sex or ethnic group.[9]

Adverse impact has become a loaded term, fraught with suggestions of ill intent on the part of the employer. It should, however, be noted that adverse impact simply describes differences between groups on a testing process. It is not a legal term that implies guilt or a psychometric term that implies unfairness or test bias. Many employers that test for relevant job skills will generate adverse impact in a testing process in one way or another and most studies show that adverse impact is not normally due to forms of bias inherent to the tests (Sackett, 2001; Neisser, 1996).

The concept of adverse impact was first delineated by the Supreme Court decision in Griggs v. Duke Power Company (1971). Under the disparate impact theory, discrimination exists when there is evidence of a statistical disparity in selection or promotion rates, unless the practice meets a business necessity. The EEOC Uniform Guidelines on Employee Selection Procedures (1978) suggested the four-fifths rule (Morris, S.B. 2001):

> *A selection rate for any race, sex, or ethnic group that is less than four-fifths (4/5 or eighty percent) of the rate for the group with the highest rate will generally be regarded by the Federal enforcement agencies as evidence of adverse impact... (Section 4D, p. 38297).*

The basic statistic used in the four-fifths rule is the Impact Ratio (IR), which is the ratio of the selection rate for the minority group (SR_{min}) to the selection rate for the majority group (SR_{maj}), or

$$IR = \frac{SR_{min}}{SR_{maj}}$$

In order to illustrate the functionality of the four-fifths rule the following two examples are presented:

1. For example: a certain organization decides to test the literacy of applicants for a position available in the organization but soon recognize some discrepancies in the results of different biographical groups. Upon further investigation, it is revealed that 76% of a certain biographical group passed the test while

[9] Biddle, D. *Adverse Impact and Test Validation – A Practitioner's Guide to Valid and Defensible Employment Testing.* Second Edition.

only 34% of a different biographical group passed. The Impact Ratio for this test is therefore calculated as 34/74 and equals 0.46. Since the Impact Ratio is smaller than 0.8 this test will constitute as having an adverse impact.

2. For example: the organization then decides to utilize a different test in which the pass rate for the first biographical group remains 74%, but the pass rate for the second group is 60%.The Impact Ratio for this test is therefore calculated as 60/74 and equals 0.81. Since the Impact Ratio is greater than or equal than 0.8 this test will not constitute as having an adverse impact.

The application of the four-fifths rule illustrates that discrepancies in the results of different biographical groups obtained from a certain employment method is not necessarily an indication of an adverse impact. An adverse impact is only created should the discrepancies be of such a scale that the four-fifths rule is violated.

Application of Adverse Impact

Adverse impact is not a homogeneous phenomenon. Although the Griggs-Albermarle rules for assessing validity are exacting, they are not equally applicable to all causes of adverse impact. They apply best to tests and other procedures that are standardized, or capable of being standardized. However, case law reveals both a lighter and a heavier standard. Biographical factors such as methadone use (for transit authority cops; New York City v. Beazer, 1979) and felony armed robbery conviction (for security guards; Hyland v. Fukada, 1978) have been successfully defended with articulations (as in McDonnell Douglas v. Green, 1973) of obvious reasons for exclusion. Cases featuring educational requirements have been successfully defended by citing federal studies supporting a high-school diploma for police officers (Davis v. Dallas, 1985) and experts testifying that a 4-year college degree is necessary to cope with the exacting training demands for commercial airline pilots (Spurlock v. United Airlines, 1972). It is arguable, of course, that the defenses above were lighter relative to Griggs-Albermarle because each involved safety sensitive positions. However, cases such as Lanning (and so many others) reveal that the defense to adverse impact by standardized tests is no less exacting for police departments as for power companies and paper mills.

At the other extreme, cases such as Dothard v. Rawlinson (1977) reveal more exacting standards for exclusion based on physical characteristics such as height and weight. Here, the standard is proving it is reasonably necessary to exclude all or most individuals who fail to meet the standard. If this sounds similar to the BFOQ (bona fide occupational qualification) defense in gender and age cases, it is. Indeed, in Dothard, the Supreme Court struck down the height and weight criteria but found it was reasonably necessary to exclude all or most women from being guards in all-male maximum-security prisons. Thus, it was easier to exclude members of an entire class than it was any individual, male or female, based on height and weight.

Therefore, case law reveals that different types of causes of adverse impact are associated with different standards for defense, and the Uniform Guidelines should reflect that fact.[10]

[10] Gutman, A (2004) *Ground Rules for Adverse Impact* – Florida Institute of Technology

The defense to adverse impact in CRA-91 is “job relatedness and consistency with business necessity,” as it is in the ADA, which was codified in 1990 (before CRA-91). As noted by Gutman (2003), taken literally “business necessity” implies a heavier defense than job relatedness.

Furthermore, there is an element of a literal meaning of business necessity in the BFOQ defense and in the Dothard ruling on height and weight criteria.

The terms “business necessity” and “job-related” are intended to reflect the concepts enunciated by the Supreme Court in Griggs v. Duke Power Co., 401 US 424 (1971), and in other Supreme Court decisions prior to Wards Cove Packing Co. v. Atonio, 490 US 642 (1989). Therefore, there is no reason to suppose the phrase “job relatedness and consistency with business necessity” changes any of the original meaning or any of the parallel terms in Griggs-Albermarle or the Uniform Guidelines

Auto Pedigree Case Study

This document will present the findings of two case studies that compare the results achieved by a number of individuals from the Shadowmatch worksheet with their actual job performance. In an attempt to improve the quality of employees within Auto Pedigree and its dealer network, a psychometric assessment validation process was embarked upon for both case studies. A comprehensive assessment battery was administered to all individuals in the case studies including employees of Auto Pedigree and its dealer network.

Case Study 1: Branch Managers

The first Auto Pedigree Case study involves the quality of Branch Managers that are employed within Auto Pedigree and its dealer network. This case study involves the assessment of 56 Branch Managers who are currently employed by Auto Pedigree in their various Dealerships. The psychometric tests were conducted by IMPERIAL ASSESSMENT CENTRE:

- Dr. Johan De Beer. Industrial psychologist (Ps 020915);
- Mr. Koos Louw. Industrial psychologist (Ps 0124621); and
- Me. Clarice Erasmus.

Objectives identified for this study were as follows:

- To develop a scientifically validated model to predict success of Branch Managers in Auto Pedigree and
- To implement a selection system that is equitable and cost-effective.

The validation sample consisted of 56 Branch Managers for which psychometric results for the following instruments were available:

- *Test of Attentional and Interpersonal Style (TAIS)*;
- *LINT Scanner*;
- *NDC Questionnaire*;
- *15FQ Personality Questionnaire*;
- The *PI*;
- The *Shadowmatch Worksheet* and
- The *Leadership Style Questionnaire*;

The initial validation results confirmed poor predictive validity for the *TAIS,* the *PI* and the *NDC Questionnaire.* Scores obtained in these instruments were therefore not taken into consideration in the analyses presented in this report.

Correlation Analysis

The following table presents the results obtained by calculating the correlation between a number of Shadowmatch habits and the accepted key performance indicators (KPI's) used in the industry:

		RETAIL UNITS SOLD	TOTAL GROSS PROFIT	1ST GROSS PROFIT	2ND GROSS PROFIT	AVERAGE 1ST GROSS PROFIT PER UNIT	AVERAGE 2ND GROSS PROFIT PER UNIT
Shadowmatch - Resilience	Pearson Correlation	-.006	-.120	-.132	-.066	-.284	-.229
	Sig. (1-tailed)	.483	.189	.166	.314	.017	.045
	N	56	56	56	56	56	56
Shadowmatch - Propensity to Change	Pearson Correlation	.311	.263	.236*	.303	.044	.018
	Sig. (1-tailed)	.010	.025	.040	.012	.373	.446
	N	56	56	56	56	56	56
Shadowmatch - Individual Inclination	Pearson Correlation	.270	.211	.199	.240	.025	-.077
	Sig. (1-tailed)	.022	.059	.071	.037	.428	.286
	N	56	56	56	56	56	56
Shadowmatch - Innovation	Pearson Correlation	.245	.210	.188	.247	.044	.050
	Sig. (1-tailed)	.035	.060	.082	.033	.373	.358
	N	56	56	56	56	56	56
Shadowmatch - People Positive	Pearson Correlation	.234	.189	.138	.203	-.020	-.056
	Sig. (1-tailed)	.042	.081	.155	.066	.443	.340
	N	56	56	56	56	56	56
Shadowmatch – Altruism	Pearson Correlation	.238	.201	.153	.208	.086	-.068
	Sig. (1-tailed)	.038	.069	.131	.062	.265	.308
	N	56	56	56	56	56	56
Shadowmatch - Task Efficiency	Pearson Correlation	-.240	-.228	-.185	-.267	.059	-.185
	Sig. (1-tailed)	.038	.045	.086	.024	.332	.086
	N	56	56	56	56	56	56
Shadowmatch – Attitude	Pearson Correlation	-.124	-.053	.013	-.096	.043	.243
	Sig. (1-tailed)	.180	.349	.462	.242	.376	.036
	N	56	56	56	56	56	56

The results highlighted in green indicate correlations between KPI's and Shadowmatch results that are very strong and statistically significant.

Multiple Regression Prediction Models

Stepwise multiple regression analysis was done, using all the scale scores of the following instruments as independent variables:

- The *LINT Scanner*;
- The *15FQ Personality Questionnaire*;
- The *Shadowmatch Worksheet* and
- The *Leadership Style Questionnaire*;

The results are shown in the Technical Tables below:

Stepwise linear regression model

VARIABLES ENTERED/REMOVED[A]				
MODEL		VARIABLES ENTERED	VARIABLES REMOVED	METHOD
	1	Shadowmatch - Task Efficiency	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
	2	15FQ – Expedient_Conscientious	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
	3	Leadership Style - Diagnostic Cluster: Conceptual	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
	4	15FQ - Hard Headed_Socially Bold	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
	5	15FQ - Positive Work Attitude	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
	6	Leadership Style - Psychological Robustness: Toughness	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
a. Dependent Variable: RETAIL UNITS SOLD - APRIL TO SEPTEMBER 2012				

Model Summary					
Model		R	R Square	Adjusted R Square	Std. Error of the Estimate
_	1	.433[a]	.188	.166	29.155
	2	.569[b]	.324	.288	26.950
	3	.645[c]	.415	.367	25.411
	4	.721[d]	.520	.465	23.363
	5	.769[e]	.591	.531	21.872
	6	.799[f]	.638	.573	20.877

a. Predictors: (Constant), Shadowmatch - Task Efficiency

b. Predictors: (Constant), Shadowmatch - Task Efficiency, 15FQ – Expedient_Conscientious

c. Predictors: (Constant), Shadowmatch - Task Efficiency, 15FQ – Expedient_Conscientious, Leadership Style - Diagnostic Cluster: Conceptual

d. Predictors: (Constant), Shadowmatch - Task Efficiency, 15FQ – Expedient_Conscientious, Leadership Style - Diagnostic Cluster: Conceptual, 15FQ - Hard Headed_Socially Bold

e. Predictors: (Constant), Shadowmatch - Task Efficiency, 15FQ – Expedient_Conscientious, Leadership Style - Diagnostic Cluster: Conceptual, 15FQ - Hard Headed_Socially Bold, 15FQ - Positive Work Attitude

f. Predictors: (Constant), Shadowmatch - Task Efficiency, 15FQ – Expedient_Conscientious, Leadership Style - Diagnostic Cluster: Conceptual, 15FQ - Hard Headed_Socially Bold, 15FQ - Positive Work Attitude, Leadership Style - Psychological Robustness: Toughness

ANOVA[G]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7468.487	1	7468.487	8.787	.005[a]
	Residual	32299.488	38	849.987		
	Total	39767.975	39			
2	Regression	12894.356	2	6447.178	8.877	.001[b]
	Residual	26873.619	37	726.314		
	Total	39767.975	39			
3	Regression	16522.018	3	5507.339	8.529	.000[c]
	Residual	23245.957	36	645.721		
	Total	39767.975	39			
4	Regression	20663.829	4	5165.957	9.464	.000[d]
	Residual	19104.146	35	545.833		
	Total	39767.975	39			
5	Regression	23502.855	5	4700.571	9.826	.000[e]
	Residual	16265.120	34	478.386		
	Total	39767.975	39			
6	Regression	25385.104	6	4230.851	9.707	.000[f]
	Residual	14382.871	33	435.845		
	Total	39767.975	39			

a. Predictors: (Constant), Shadowmatch - Task Efficiency

b. Predictors: (Constant), Shadowmatch - Task Efficiency, 15FQ - Expedient_Conscientious

c. Predictors: (Constant), Shadowmatch - Task Efficiency, 15FQ - Expedient_Conscientious, Leadership Style - Diagnostic

Cluster: Conceptual
d. Predictors: (Constant), Shadowmatch - Task Efficiency, 15FQ - Expedient_Conscientious, Leadership Style - Diagnostic Cluster: Conceptual, 15FQ - Hard Headed_Socially Bold
e. Predictors: (Constant), Shadowmatch - Task Efficiency, 15FQ - Expedient_Conscientious, Leadership Style - Diagnostic Cluster: Conceptual, 15FQ - Hard Headed_Socially Bold, 15FQ - Positive Work Attitude
f. Predictors: (Constant), Shadowmatch - Task Efficiency, 15FQ - Expedient_Conscientious, Leadership Style - Diagnostic Cluster: Conceptual, 15FQ - Hard Headed_Socially Bold, 15FQ - Positive Work Attitude, Leadership Style - Psychological Robustness: Toughness
g. Dependent Variable: RETAIL UNITS SOLD - APRIL TO SEPTEMBER 2012

Coefficients[A]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	127.735	18.942		6.744	.000
	Shadowmatch - Task Efficiency	-1.291	.435	-.433	-2.964	.005
2	(Constant)	211.130	35.179		6.002	.000
	Shadowmatch - Task Efficiency	-1.345	.403	-.452	-3.338	.002
	15FQ - Expedient_Conscientious	-4.075	1.491	-.370	-2.733	.010
3	(Constant)	242.696	35.744		6.790	.000
	Shadowmatch - Task Efficiency	-1.546	.389	-.519	-3.972	.000
	15FQ - Expedient_Conscientious	-3.412	1.433	-.310	-2.381	.023
	Leadership Style - Diagnostic Cluster: Conceptual	-.746	.315	-.316	-2.370	.023
4	(Constant)	226.017	33.416		6.764	.000
	Shadowmatch - Task Efficiency	-1.565	.358	-.525	-4.371	.000
	15FQ - Expedient_Conscientious	-3.359	1.318	-.305	-2.549	.015
	Leadership Style - Diagnostic Cluster: Conceptual	-.912	.296	-.386	-3.085	.004
	15FQ - Hard Headed_Socially Bold	2.048	.743	.330	2.755	.009
5	(Constant)	170.582	38.684		4.410	.000
	Shadowmatch - Task Efficiency	-1.376	.344	-.462	-4.001	.000
	15FQ - Expedient_Conscientious	-3.908	1.254	-.355	-3.116	.004
	Leadership Style - Diagnostic Cluster: Conceptual	-.880	.277	-.372	-3.175	.003

	15FQ - Hard Headed_Socially Bold	2.355	.707	.379	3.329	.002
	15FQ - Positive Work Attitude	1.906	.782	.283	2.436	.020
6	(Constant)	210.533	41.629		5.057	.000
	Shadowmatch - Task Efficiency	-1.391	.328	-.467	-4.235	.000
	15FQ - Expedient_Conscientious	-4.393	1.220	-.399	-3.602	.001
	Leadership Style - Diagnostic Cluster: Conceptual	-.879	.265	-.372	-3.323	.002
	15FQ - Retiring_Socially Bold	2.626	.688	.423	3.819	.001
	15FQ - Positive Work Attitude	1.615	.760	.240	2.126	.041
	Leadership Style - Psychological Robustness: Toughness	-.463	.223	-.233	-2.078	.046
a. Dependent Variable: RETAIL UNITS SOLD - APRIL TO SEPTEMBER 2012						

Relevant scale descriptions

Shadowmatch Task Efficiency: When someone completes the Shadowmatch worksheet, it represents an end-to-end task during which every individual tends to present a level of efficiency. These efficiencies are being presented as recurring patterns or habits. This is a combination of how they manage their time, how efficient they are in doing the job end to end and how successfully they are in getting the job done correctly. The Task Efficiency graph calculates the relative efficiency with which the individual has completed the task of working through the Shadowmatch Worksheet. It combines total time, conceptual results and time used for the conceptual questions into a single percentage of relative efficiency. The full meaning of this calculation is a cold factual calculation of how the individual has taken ownership of a task successfully and effectively. That task being to complete the Shadowmatch Worksheet.

Leadership Style Questionnaire: Conceptual and Toughness Scales:

LEADERSHIP PROFILE																						
LEADERSHIP DIMENSION	DESCRIPTION: LEFT SIDE OF SCALE	EXTREME LEFT					MID-LEFT			MID-RANGE				MID-RIGHT			EXTREME RIGHT					DESCRIPTION: RIGHT SIDE OF SCALE
DIAGNOSTIC CLUSTER		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	
Conceptual	Practical and pragmatic, more concrete in action.																					Uses models to guide thinking, enjoys abstract thought, thinks multi-dimensionally.
PSYCHOLOGICAL ROBUSTNESS CLUSTER		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	
Toughness	More sensitive, gentler orientation.																					Does not give up, not easily hurt.

15FQ: Expedient – Conscientious:

Expedient: Spontaneous, Disregarding of Rules and Obligations

Conscientious: Dutiful, Persevering, Detail-conscious

15FQ: Retiring – Socially Bold:

Retiring: Timid, Socially anxious, Hesitant in Social Settings, Shy

Socially Bold: Venturesome, Socially confident

Case Study Conclusion

The Case Study indicated a strong correlation between the KPI performance of the individuals tested and the corresponding habit scores of the Shadowmatch worksheet thereby corroborating the methods employed in the Shadowmatch worksheet by proving a direct relationship between certain habits as defined by Shadowmatch and successful job performance.

The case study also indicated that the Shadowmatch measure (task efficiency) compared to other tools testing in five models delivered the highest correlations between a selected measure and the performance of the employee.

Case Study 2: Sales Representatives

In an attempt to improve the quality of Sales Representatives that are employed within Auto Pedigree and its dealer network, a psychometric assessment process was embarked upon. A comprehensive assessment battery was administered to 209 Sales Representatives that are currently employed by Auto Pedigree in their various Dealerships. The Psychometric tests were undertaken by IMPERIAL ASSESSMENT CENTRE:

- Dr. Johan De Beer. Industrial psychologist (Ps 020915); and
- Christa Louw. Intern psychologist (Ps s 0113999).

Objectives identified for this study are as follows:

- To develop a scientifically validated model to predict success of Sales Representatives in Auto Pedigree;
- To implement a selection system that is equitable; and
- To reduce the cost of the selection process by using only the most optimal selection battery.

Research Methodology

The research was conducted on a sample of 209 Sales Representatives within Auto Pedigree during July & August 2012. A comprehensive assessment battery was used to assess various habits, behavior and aptitude of these employees. Performance data for the employees who were assessed were made available. Quantitative research techniques were utilized, in order to identify and develop a scientifically validated model to predict success of Sales Representatives in Auto Pedigree.

Sample Selection

The sample consisted of 209 Sales Representatives for which the psychometric scores on the following instruments were available:

- Differential Aptitude Test;
- LINT Scanner;
- NDC Questionnaire;
- 15FQ Personality Questionnaire;
- Shadowmatch Worksheet
- Sales Preference Index (SPI) and
- Predictive Index Questionnaire.

The assessment results, together with performance data were utilized during the validation process. The composition of the total sample can be seen in Figure 1 to Figure 4 below.

Figure 1: Gender

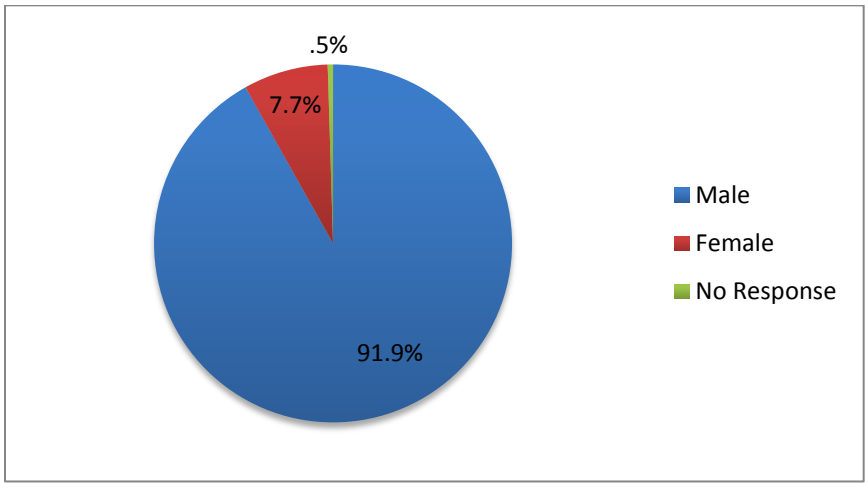


Figure 2: Population Group

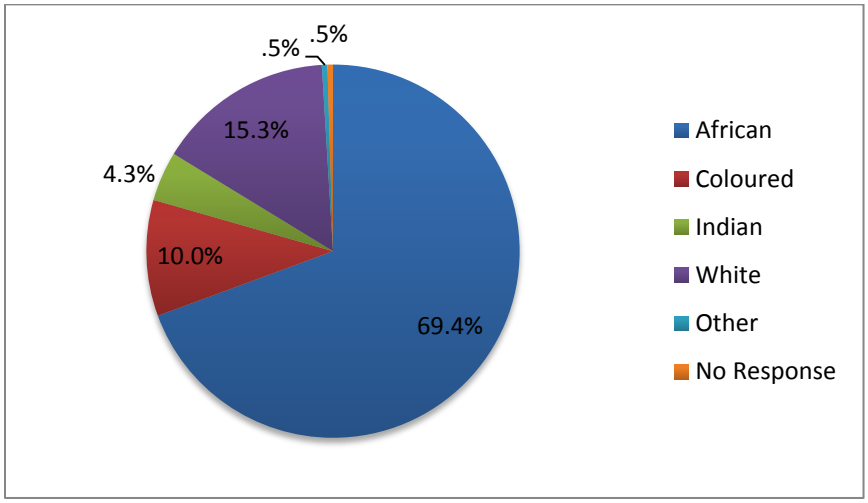


Figure 3: Highest Qualification

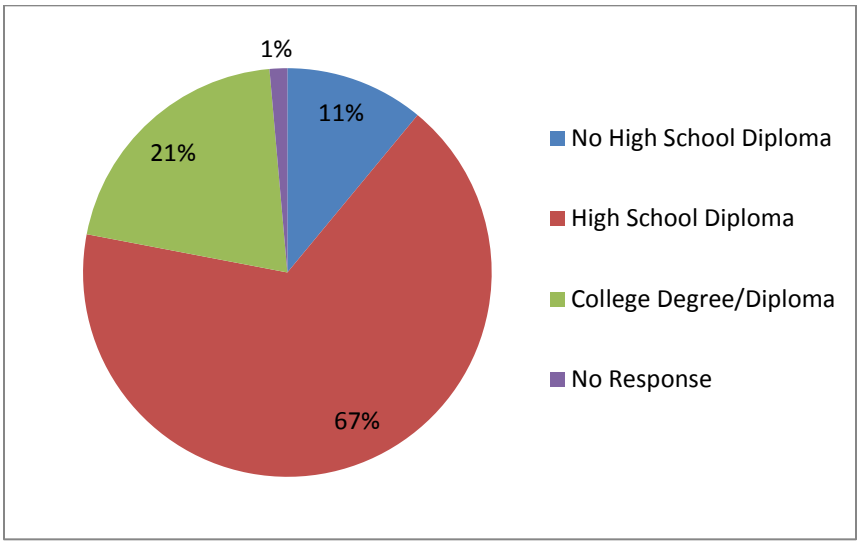
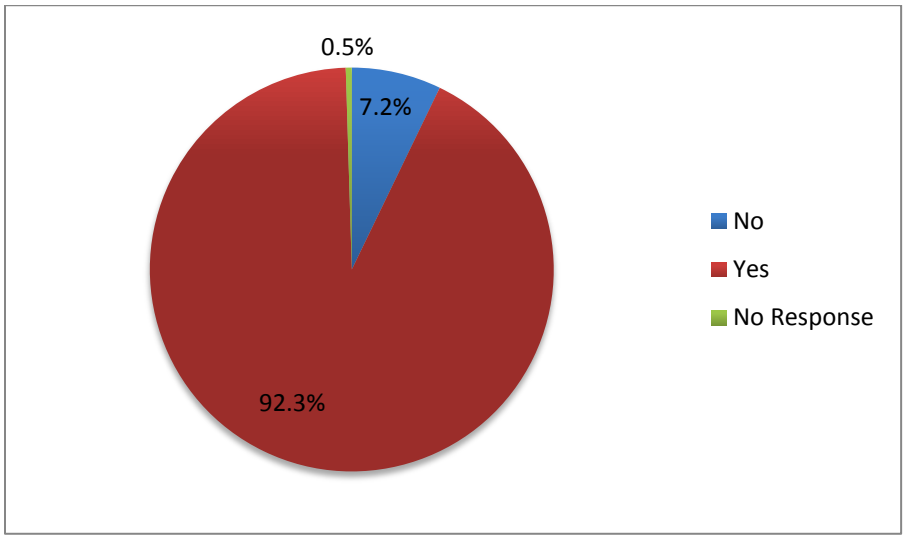


Figure 4: Do you have experience in the car sales industry?



Performance data

The initial statistical analysis was done by using various performance measures that were available for the period 1 June 2011 to 31 May 2012. The second round of statistical analysis, for which the results are reflected in this report, were done by using various performance measures for the period 1 June 2011 to 31 August 2012. This gave the researchers the opportunity to enlarge the sample used in the statistical analysis process because more performance data was available. The following performance metrics were used during the second round of our analyses:

- Average units that an employee has sold per month over the 1 June '11 - 31 August '12 period;
- Average 1st Gross Profit that an employee has achieved per month over the 1 June '11 - 31 August '12 period;
- Average 2nd Gross Profit that an employee has achieved per month over the 1 June '11 - 31 August '12 period;
- Average 1st Gross Profit that an employee has achieved per unit over the 1 June '11 - 31 August '12 period and
- Average second Gross Profit that an employee has achieved per unit over the 1 June '11 - 31 August '12 period.

Final validation sample of second statistical analysis phase

As discussed in the initial results documented, in order to reduce the impact of extraneous variables and to ensure the reliability of the data, the following records were still eliminated from the second round of statistical analyses:

1. Employees with a low level of measured English Proficiency (DAT Test 5 Reading Comprehension $\leq$ Stanine 3);
2. Employees with possible dysfunctional emotional dynamics (LINT Scanner Section E $\geq$ 8) and
3. Employees for whom no performance data was available or employees who have not been employed at Auto Pedigree for a long period (employees with less than 6 months of performance data in the 15-month period).

After the selection of cases were done based on the above criteria, 110 cases (N=110), remained on which all the analyses were done.

Correlation Analysis

Simple correlation analysis was conducted to determine whether there is a relationship, and if so, the nature of the relationship between performance ratings and construct scores on the various psychometric instruments. Statistically significant correlation coefficients are displayed in Table 1 on the next page.

Table 1: Significant correlation results

		Average Units per Month	Average 1st Gross Profit per Month	Average 2nd Gross Profit per Month	Average 1st Gross per Unit	Average 2nd Gross per Unit
Car Sales Experience Period	Pearson Correlation	.253	.214	.219	.011	.018
	Sig. (1-tailed)	.004	.012	.011	.454	.427
	N	110	110	110	110	110
	Sig. (1-tailed)	.470	.391	.186	.127	.017
	N	94	94	94	94	94
Shadowmatch - Propensity to Own	Pearson Correlation	.066	.018	-.030	-.089	-.160
	Sig. (1-tailed)	.246	.425	.378	.178	.048
	N	109	109	109	109	109
Shadowmatch - To Simplify	Pearson Correlation	.115	.087	.001	-.026	-.165
	Sig. (1-tailed)	.116	.184	.495	.394	.043
	N	109	109	109	109	109
Shadowmatch - Responsiveness	Pearson Correlation	.162	.136	.038	.028	-.161
	Sig. (1-tailed)	.046	.080	.347	.386	.047
	N	109	109	109	109	109
Shadowmatch - Self Confidence	Pearson Correlation	.053	.025	-.047	-.026	-.209
	Sig. (1-tailed)	.293	.400	.315	.396	.015
	N	109	109	109	109	109
Shadowmatch - Task Efficiency	Pearson Correlation	.090	.123	-.046	.061	-.238
	Sig. (1-tailed)	.177	.102	.317	.265	.006
	N	109	109	109	109	109

The results highlighted in green indicate correlations between KPI's and Shadowmatch results that are very strong and statistically significant.

Performance Prediction Models - CHAID Analysis

CHAID analyses were also done to determine which of the test constructs have predictive validity for success as a Sales Representative. The results can be seen below. The CHAID analysis (Chi-squared automatic interaction detection) is used to determine the interaction between variables and provides a framework that indicates which combinations will provide the best predictive accuracy. When considering Shadowmatch in the use of CHAID analysis it is important to remember that the strength of a habit can be inversely proportionate to the performance. Thus, a bad performance related to high scores can still be used to indicate that the benchmark will have a low score on the selected habit which will have the same predictive strength than a high score correlating to good performance.

Figure 6: CHAID - Average Units Sold per Month

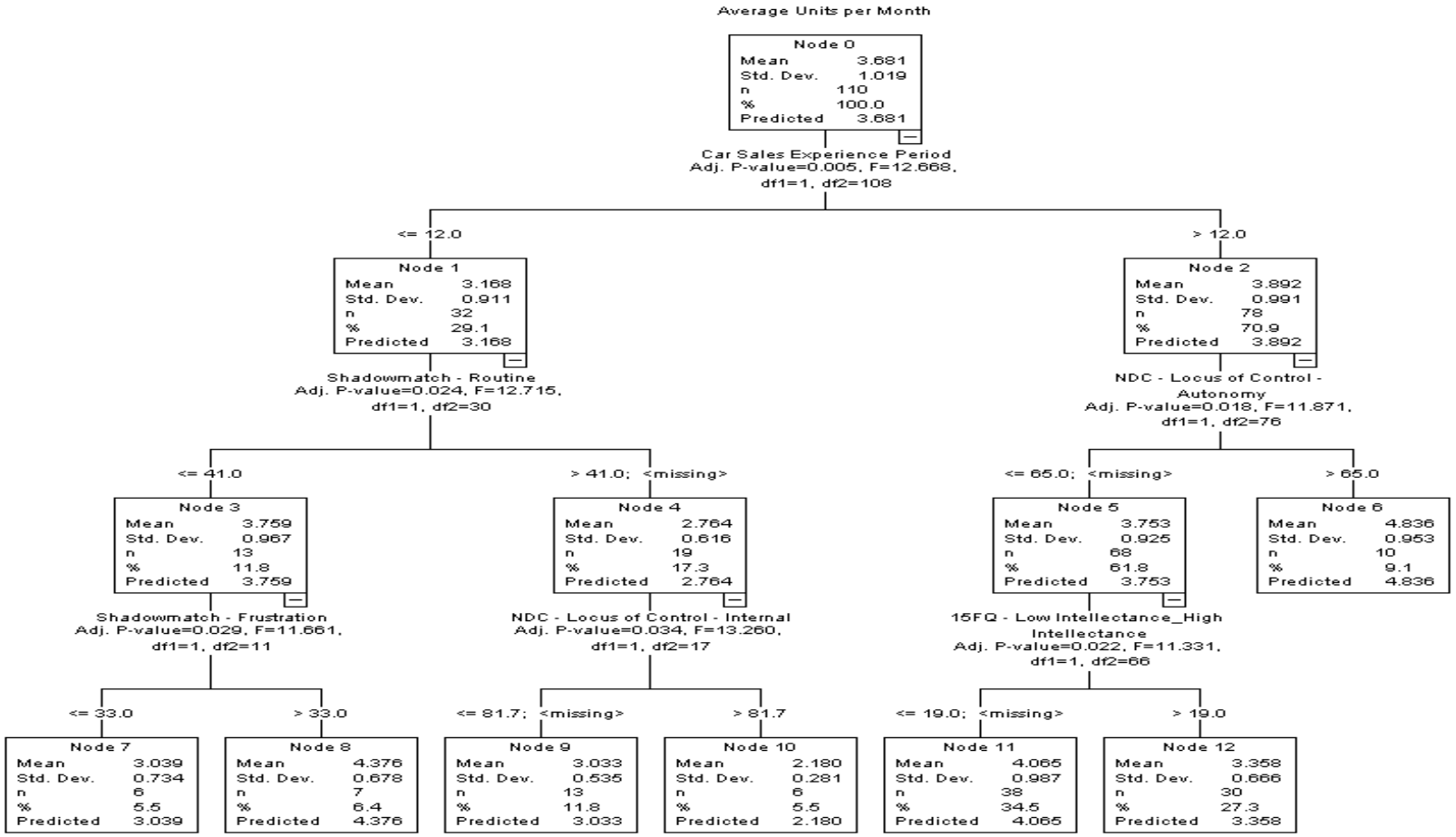


Figure 7: CHAID - Average 1st Gross Profit per Month

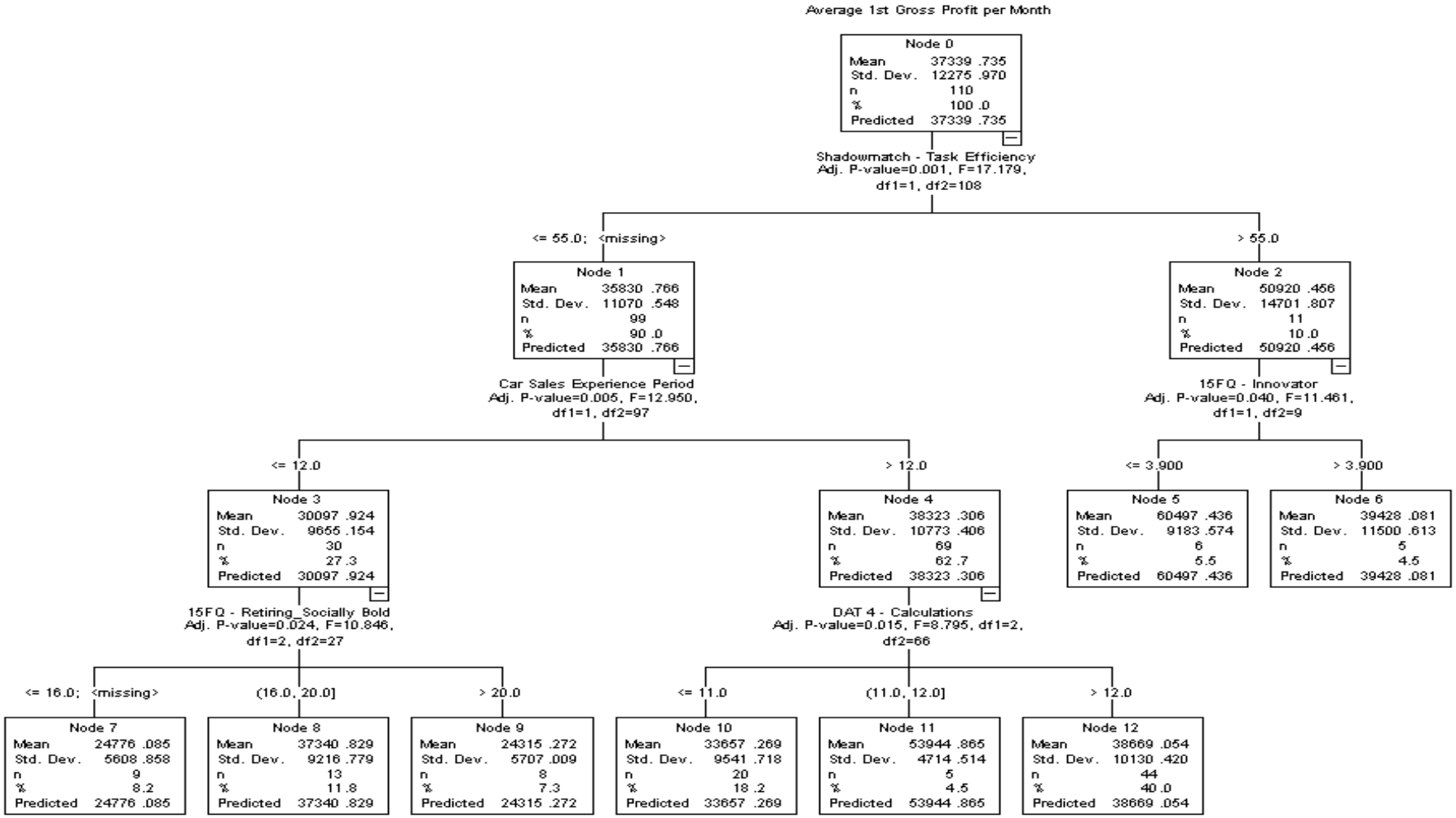
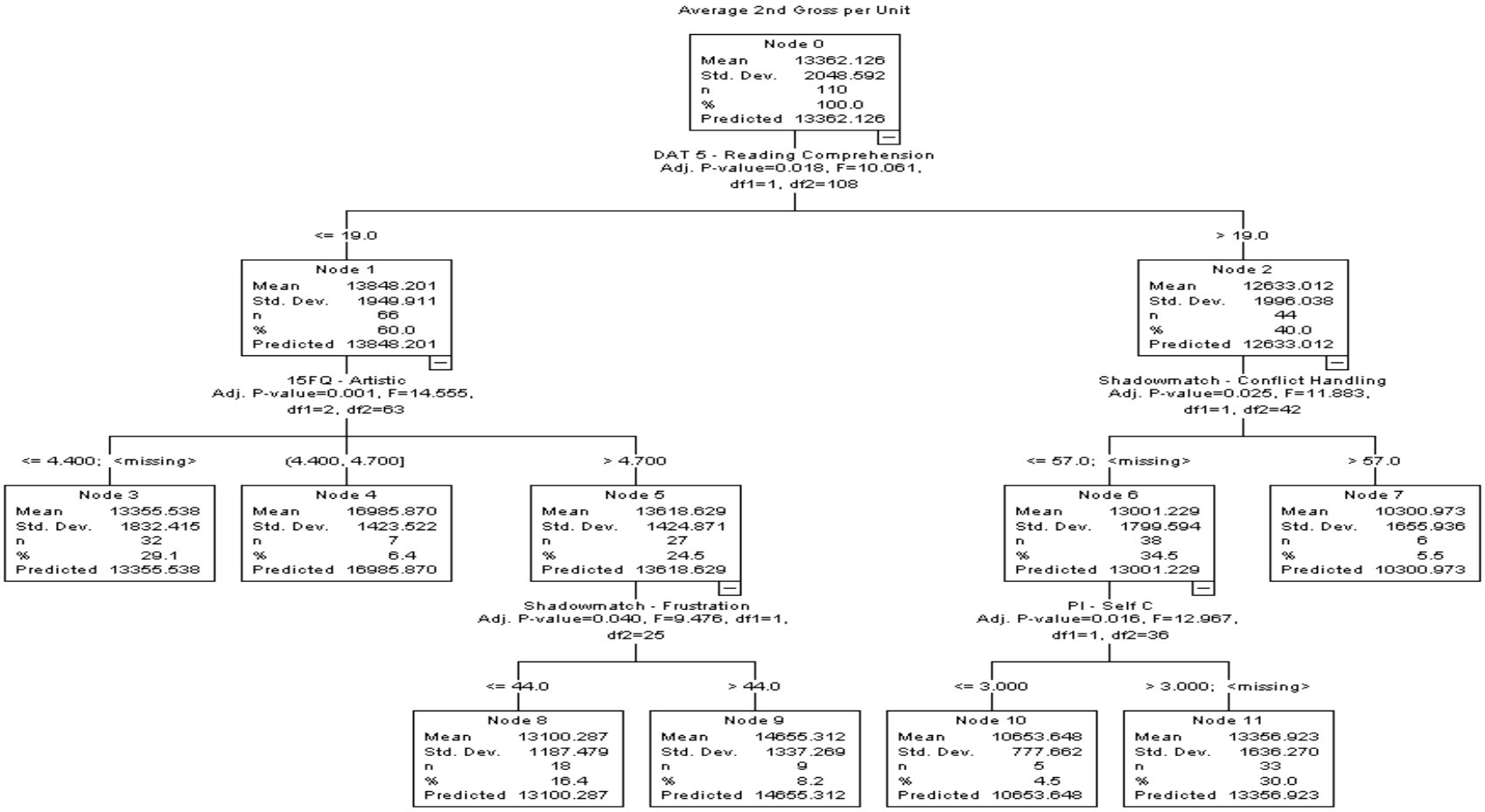


Figure 8: CHAID - Average 2nd Gross Profit per Unit



Initial Case Study Findings

Both the Simple Correlation Analysis and the CHAID Analysis revealed the huge influence that car sales experience has on sales performance. Therefore, it was decided to conduct partial correlation analysis where we could control for the influence of car sales experience. The results can be seen in Table 2 below.

Table 2: Significant Partial Correlation Analysis Results

Control Variables: Car Sales Experience			**Average Units per Month**
	Shadowmatch - Propensity to Change	Correlation	.148
	Shadowmatch - Self Motivation	Correlation	.158
	Shadowmatch – Responsiveness	Correlation	.198
	Shadowmatch – Innovation	Correlation	.152
	Shadowmatch - Self Confidence	Correlation	.138
Figures highlighted in green indicate a strong correlation between performance and Shadowmatch scores			

Stepwise linear regression models

Regression: Average Units per Month

Variables Entered/Removed[a]				
Model		Variables Entered	Variables Removed	Method
1	1	Shadowmatch - Responsiveness	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
	2	15FQ - Direct_Restrained	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
	3	15FQ - Distant, Aloof_Empathetic	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
			.	
a. Dependent Variable: Average Units per Month				

Model Summary					
Model		R	R Square	Adjusted R Square	Std. Error of the Estimate
1	1	.221[a]	.049	.041	1.09437
	2	.295[b]	.087	.071	1.07680
	3	.417[c]	.174	.152	1.02897
a. Predictors: (Constant), Shadowmatch - Responsiveness					
b. Predictors: (Constant), Shadowmatch - Responsiveness, 15FQ - Direct_Restrained					
c. Predictors: (Constant), Shadowmatch - Responsiveness, 15FQ - Direct_Restrained, 15FQ - Distant, Aloof_Empathetic					

ANOVA[E]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	7.069	1	7.069	5.902	.017[a]
	Residual	137.728	115	1.198		
	Total	144.797	116			
2	Regression	12.613	2	6.307	5.439	.006[b]
	Residual	132.184	114	1.160		
	Total	144.797	116			
3	Regression	25.156	3	8.385	7.920	.000[c]
	Residual	119.641	113	1.059		
	Total	144.797	116			
a. Predictors: (Constant), Shadowmatch - Responsiveness						
b. Predictors: (Constant), Shadowmatch - Responsiveness, 15FQ - Direct_Restrained						
c. Predictors: (Constant), Shadowmatch - Responsiveness, 15FQ - Direct_Restrained, 15FQ - Distant, Aloof_Empathetic						
e. Dependent Variable: Average Units per Month						

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.523	.468		5.395	.000
	Shadowmatch - Responsiveness	.025	.010	.221	2.429	.017
2	(Constant)	1.360	.703		1.935	.055
	Shadowmatch - Responsiveness	.027	.010	.243	2.699	.008
	15FQ - Direct_Restrained	.054	.024	.197	2.187	.031
3	(Constant)	2.420	.739		3.275	.001
	Shadowmatch - Responsiveness	.025	.010	.219	2.542	.012
	15FQ - Direct_Restrained	.098	.027	.361	3.668	.000
	15FQ - Distant, Aloof_Empathetic	-.101	.029	-.339	-3.442	.001
a. Dependent Variable: Average Units per Month						

Regression: Average 1st Gross Profit per Month

Variables Entered/Removed[A]				
Model		Variables Entered	Variables Removed	Method
	1	15FQ - Distant, Aloof_Empathetic	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
	2	15FQ - Direct_Restrained	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
	3	Shadowmatch - Responsiveness	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
	4	15FQ - Conventional_Radical	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
	5	NDC - Locus of Control - External	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
a. Dependent Variable: Average 1st Gross Profit per Month				

Model Summary					
Model		R	R Square	Adjusted R Square	Std. Error of the Estimate
	1	.264[a]	.070	.062	12734.93416
	2	.416[b]	.173	.158	12062.44244
	3	.479[c]	.229	.209	11694.07365
	4	.520[d]	.270	.244	11429.67861
	5	.546[e]	.298	.266	11262.38835
a. Predictors: (Constant), 15FQ - Distant, Aloof_Empathetic					

b. Predictors: (Constant), 15FQ - Distant, Aloof_Empathetic, 15FQ - Direct_Restrained
c. Predictors: (Constant), 15FQ - Distant, Aloof_Empathetic, 15FQ - Direct_Restrained, Shadowmatch - Responsiveness
d. Predictors: (Constant), 15FQ - Distant, Aloof_Empathetic, 15FQ - Direct_Restrained, Shadowmatch - Responsiveness, 15FQ - Conventional_Radical
e. Predictors: (Constant), 15FQ - Distant, Aloof_Empathetic, 15FQ - Direct_Restrained, Shadowmatch - Responsiveness, 15FQ - Conventional_Radical, NDC - Locus of Control - External

ANOVA[F]

MODEL		SUM OF SQUARES	DF	MEAN SQUARE	F	SIG.
1	Regression	1.398E9	1	1.398E9	8.622	.004[a]
	Residual	1.865E10	115	1.622E8		
	Total	2.005E10	116			
2	Regression	3.462E9	2	1.731E9	11.895	.000[b]
	Residual	1.659E10	114	1.455E8		
	Total	2.005E10	116			
3	Regression	4.596E9	3	1.532E9	11.203	.000[c]
	Residual	1.545E10	113	1.368E8		
	Total	2.005E10	116			
4	Regression	5.417E9	4	1.354E9	10.367	.000[d]
	Residual	1.463E10	112	1.306E8		
	Total	2.005E10	116			
5	Regression	5.969E9	5	1.194E9	9.412	.000[e]
	Residual	1.408E10	111	1.268E8		

	Total	2.005E10	116			

a. Predictors: (Constant), 15FQ - Distant, Aloof_Empathetic

b. Predictors: (Constant), 15FQ - Distant, Aloof_Empathetic, 15FQ - Direct_Restrained

c. Predictors: (Constant), 15FQ - Distant, Aloof_Empathetic, 15FQ - Direct_Restrained, Shadowmatch - Responsiveness

d. Predictors: (Constant), 15FQ - Distant, Aloof_Empathetic, 15FQ - Direct_Restrained, Shadowmatch - Responsiveness, 15FQ - Conventional_Radical

e. Predictors: (Constant), 15FQ - Distant, Aloof_Empathetic, 15FQ - Direct_Restrained, Shadowmatch - Responsiveness, 15FQ - Conventional_Radical, NDC - Locus of Control - External

f. Dependent Variable: Average 1st Gross Profit per Month

COEFFICIENTS[A]

MODEL		UNSTANDARDIZED COEFFICIENTS		STANDARDIZED COEFFICIENTS	T	SIG.
		B	STD. ERROR	BETA		
1	(Constant)	53472.030	5792.665		9.231	.000
	15FQ - Distant, Aloof_Empathetic	-924.800	314.948	-.264	-2.936	.004
2	(Constant)	41732.505	6310.599		6.613	.000
	15FQ - Distant, Aloof_Empathetic	-1557.604	342.392	-.445	-4.549	.000
	15FQ - Direct_Restrained	1177.913	312.805	.368	3.766	.000
3	(Constant)	25157.501	8399.263		2.995	.003
	15FQ - Distant, Aloof_Empathetic	-1481.560	332.985	-.423	-4.449	.000
	15FQ - Direct_Restrained	1229.965	303.790	.384	4.049	.000
	Shadowmatch -	316.807	109.997	.240	2.880	.005

	Responsiveness					
4	(Constant)	36368.495	9347.766		3.891	.000
	15FQ - Distant, Aloof_Empathetic	-1477.331	325.460	-.422	-4.539	.000
	15FQ - Direct_Restrained	989.032	312.079	.309	3.169	.002
	Shadowmatch - Responsiveness	320.282	107.519	.243	2.979	.004
	15FQ - Conventional_Radical	-754.212	300.763	-.216	-2.508	.014
5	(Constant)	45530.831	10204.472		4.462	.000
	15FQ - Distant, Aloof_Empathetic	-1577.349	324.261	-.450	-4.864	.000
	15FQ - Direct_Restrained	1056.515	309.208	.330	3.417	.001
	Shadowmatch - Responsiveness	260.080	109.805	.197	2.369	.020
	15FQ - Conventional_Radical	-806.646	297.425	-.231	-2.712	.008
	NDC - Locus of Control - External	-180.448	86.499	-.175	-2.086	.039
a. Dependent Variable: Average 1st Gross Profit per Month						

Regression: Average 2nd Gross Profit per Month

Variables Entered/Removed[A]			
Model	Variables Entered	Variables Removed	Method
1	15FQ - Direct_Restrained	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
2	15FQ - Distant, Aloof_Empathetic	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a. Dependent Variable: Average 2nd Gross Profit per Month

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.245[a]	.060	.052	16748.14684
2	.364[b]	.133	.117	16156.80541

a. Predictors: (Constant), 15FQ - Direct_Restrained

b. Predictors: (Constant), 15FQ - Direct_Restrained, 15FQ - Distant, Aloof_Empathetic

ANOVA[c]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.053E9	1	2.053E9	7.319	.008[a]
	Residual	3.226E10	115	2.805E8		
	Total	3.431E10	116			
2	Regression	4.552E9	2	2.276E9	8.719	.000[b]
	Residual	2.976E10	114	2.610E8		
	Total	3.431E10	116			

a. Predictors: (Constant), 15FQ - Direct_Restrained
b. Predictors: (Constant), 15FQ - Direct_Restrained, 15FQ - Distant, Aloof_Empathetic
c. Dependent Variable: Average 2nd Gross Profit per Month

COEFFICIENTS[A]						
MODEL		UNSTANDARDIZED COEFFICIENTS		STANDARDIZED COEFFICIENTS	T	SIG.
		B	STD. ERROR	BETA		
1	(Constant)	27437.448	7591.855		3.614	.000
	15FQ - Direct_Restrained	1023.759	378.406	.245	2.705	.008
2	(Constant)	40493.656	8452.609		4.791	.000
	15FQ - Direct_Restrained	1659.972	418.980	.397	3.962	.000
	15FQ - Distant, Aloof_Empathetic	-1418.886	458.611	-.310	-3.094	.002
a. Dependent Variable: Average 2nd Gross Profit per Month						

Case Study Conclusion

The Case Study indicates a strong correlation between the performance of the individuals based on their KPI's and the habit scores achieved on the Shadowmatch worksheet thereby corroborating the methods employed in the Shadowmatch worksheet. This correlation became especially evident went the effects of the individual's experience was accounted for.

The case study also indicated that there are strong correlations between certain habits and the performance in terms of sales as well as that certain habits can be used as predictive indicators. This implies that Shadowmatch can be used to predict the performance of sales agents based on statistical significant correlations and predefined confidence levels.

University of Pretoria Case Study

The purpose of this study is to investigate the possible correlation between the Shadowmatch results of a certain individual and the academic performance of the individual through an analysis of first year mining engineering students at the University of Pretoria as a case study.

Method

In order to analyze the way that applicants interact with the worksheet the habit score of each applicant was defined as a dependent variable and the academic results and number of courses attended by the individual was defined as an independent variable. The correlation between the dependent and independent variables where then calculated to determine whether the correlation is statistically significant.

A Pearson product-moment correlation will be used to shows the strength of the relationship between two continuous variables. It is suitable for use if it can be assumed that the variables are approximately normally distributed. An 'r' value is calculated that indicates the strength of the correlation. An 'r' of -1 is a perfect negative correlation, an 'r' of 1 is a perfect positive correlation, and an 'r' of 0 means there is no correlation.

Using this approach, it can be determined whether applicants with certain habit scores on Shadowmatch are more likely to achieve positive academic results compared to applicants with different habit scores. The table on the next page presents the findings ('r' values) of the study:

Habits	Average	Subjects
Time conceptual	-0.025567134	0.121251572
Time total	-0.067591888	-0.123370957
Conceptual questions correct	0.12561261	0.072208963
Conceptual Capabilities	0.12561261	0.072208963
Propensity to Own	0.250410686	0.063578137
Propensity to Hand off	-0.231178494	0.028484428
To Simplify	0.133303435	0.220852112
Resilience	0.019536625	0.196682047
Propensity to Change	0.098178049	0.030631498
Frustration	0.002689644	0.123213808
Team Inclination	-0.178559989	0.209331945
Individual Inclination	0.165847482	-0.241385718
Self-motivation	0.044633755	0.060895868
Routine	0.000577311	-0.058091611
Problem Solving	0.104394358	0.182545047
Responsiveness	0.131750074	0.158327619
Innovation	0.090363656	-0.029522075
People Positive	-0.053246452	0.128362461
Discipline	0.072518438	0.200440935
Conflict Handling	0.067691705	0.220537419
Altruism	-0.045580637	0.016210194
Self Confidence	0.13199859	0.336463516
Leadership	0.034971866	0.316162456
Task Efficiency	0.172169209	0.159689772
a1	-0.01506142	0.191038313
a2	0.068717261	0.314435559
a3	-0.286939225	-0.409011805
a4	0.108107412	-0.047679936
Average	1	0.569097335
Subjects	0.569097335	1

The results clearly indicate a very strong correlation between the habits identified by the Shadowmatch worksheet and the academic results of the students in the case study. All habits that indicate a very strong correlation (negative or positive) between the academic results of the individual and the individual's Shadowmatch score are indicated in green. This indicates that the Shadowmatch worksheet results of an individual can be used to determine the likelihood of the individually excelling in this academic environment.

The case study also indicates a strong positive correlation between the number of subjects taken and the academic results of the individual.

Case Study Conclusion

The case study indicates a clear correlation between the results achieved from the Shadowmatch worksheet and the academic performance if the individuals studied. This case study therefore validates the performance of the Shadowmatch worksheet and the habits of individuals in identifying the individuals best adapted to the academic environment.

Conclusion

The case studies presented in this report indicate a clear correlation between the results achieved from the Shadowmatch worksheet and the work performance of the individuals studied. This report therefore validates the performance of the Shadowmatch worksheet to identify the individuals best adapted to a specific job requirement and work environment.

The application of the Shadowmatch worksheet to a group of individuals will therefore provide results based on the ability of the individuals to perform the required job successfully as long as the benchmark is selected appropriately according to the Shadowmatch guidelines for selecting a benchmark.

Should the application of the Shadowmatch worksheet to a specific group therefore provide results that appear to indicate an adverse impact towards a specific biographical group it can be concluded that this variance in selection rates is caused by the influence of external factors and not any discrimination on the part of the Shadowmatch worksheet.

The Shadowmatch worksheet will therefore present findings that are an accurate estimation of the job related capabilities of the individual tested.

10. Legal Impact

Habits, Diversity and Emotional Intelligence – A Case Study

H van Schalkwyk (MA. Industrial Psychology)

> *"Habit is the enormous flywheel of society, its most precious conservative agent. It alone is what keeps all within bounds of ordinance… It keeps the fisherman and the deck-hand at the sea through the winter; it holds the miner in his darkness, and hails the countryman to his log-cabin and his lonely farm through all the months of snow… It dooms us all to fight out the battle of life upon the lines of our nurture or our early choice and to make the best of a pursuit that disagrees, because there is no other for which we are fitted…"*
>
> - William James, Principles of Psychology, 1890

Introduction

Habits are learned behavior or automated response dispositions that are repeated regularly without thinking. These actions are triggered by aspects of the context such as the environment or preceding events (Neal, Wood & Quinn, 2006). Shadowmatch has been developed to specifically measure the habits that are triggered within a specific working environment. These habits are usually necessary behaviors for an individual to be able to perform in that specific context.

People with the same habits can still be diverse regarding their backgrounds. Diversity is defined as the differences and similarities that exist among people. (Kreitner & Kinicki, 2001). Three major areas of diversity are identified namely demographic characteristics that includes culture, ethnicity, language, age, gender, religion, etc.; personal characteristics such as values, beliefs, lifestyles, etc.; and abilities and skills from a variety of different disciplines and areas of work (Johnson & Johnson, 2003).

Finally, emotional intelligence has become a buzz word in the last couple of years. It is an integral part of psychometric testing and personal development in the workplace. Emotional intelligence represents the understanding and managing of our emotional responses. It is the ability to deal effectively with daily environmental demands and pressures.

Now, how do these three areas fit together?

Rationale

The purpose of this case study is to illustrate that people from different backgrounds, cultures, religions, ethnicities, age and gender as well as different emotional intelligence abilities can still share the same habits, which make them successful in a specific working environment doing a specific job.

Description

A prominent Mining Company has decided to roll out six new positions in their Information Technology Department, specializing in the configuration and maintenance of information technology programs used by the company. As part of the selection criteria ShadowMatch was used as a screening tool in the process. It was done specifically to establish whether candidates had the same habits of those people that were successful currently within that job environment.

It was required that the top performers in the Information Technology Department, doing the specific job mentioned, should complete the ShadowMatch worksheet in order to establish the benchmark for the applicants. Two employees were identified as top performers; a white male, late 50s and a black female, mid 20s. After completion of the worksheet these two totally diverse individuals; regarding age, cultural background, ethnicity, language and gender matched each other's habits 92%! This means that they were 92% the same regarding the measured behavioral outputs in the working environment.

Five critical habits were also identified. These were their strongest habits and of great necessity in the effectiveness of their work. Both the individuals have indicated the following strong habits …

- Responsiveness (the habit of acting immediately)
- Discipline (the habit of working in an environment where adherence to structure, rules and regulations and time frames are imperative)
- Resilience (applying oneself relentlessly to solve problems and overcome challenges)
- Self-confidence (the habit of acting with a high level of trust in your abilities, qualities and judgment, knowing who you are and what you can and can't do)
- Simplification (the habit of breaking complex scenarios down to linear challenges that can easily be solved).

What was interesting was the fact that even though these two individuals shared the same habits, their emotional intelligence composite scales were markedly different from one another. Both individuals completed the Bar-On EQi previously for developmental purposes. The most significant difference was evident in the interpersonal realm. This realm is concerned with what is known as people skills. It indicates that when a person functions effectively in this area, this individual tends to be responsible and dependable. They understand, interact with and relate well to others in different situations. These individuals inspire trust and function adequately as part of a team (Stein & Book, 2006).

The white male indicated effective functioning in the realm of interpersonal skills, whereas the black female indicated this area as an area of enrichment. Referring back to the habits of Shadowmatch, habits regarding people skills are also measured. These areas are called people positive, altruism and team inclination. I would also like to include the habit of conflict handling because a combination of emotional intelligence scales; including some of the subscales in the interpersonal realm; makes up effective conflict handling abilities.

Both individuals assessed on ShadowMatch demonstrated the habit of working with people in a positive way, building positive relationships, influencing others in a positive way, willingness to assist others without expecting something back as well as working with others as part of a team. The habit of conflict handling, taking on a problem or situation and dealing with it also registered as a strong behavioral outcome.

The results from the Bar-On EQi demonstrated that the black female lacked effective coping skills regarding the composite scale of empathy. Empathy is the ability to emotionally read other people, to be able to understand others and give consideration to their perspectives (Stein & Book, 2006). It might also be an indication that she behaves very selectively regarding empathy towards others. Her social responsibility scale also indicated limited or restricted ability towards being a cooperative, contributing and constructive member of a team or social group (Stein & Book, 2006). Regarding her ability towards interpersonal relationships, she seems to be just barely effective, indicating that there is still room for improvement in this particular area. Handling conflict in an effective and constructive manner ties closely in with these three composite scales.

Taking all the results into consideration, I took the time to speak to these two individual's line manager. I asked her about their behavior at work and how they handled tasks. Her answer verified the test results. Both individuals were extremely effective at their work, always reaching targets and outperforming what is expected of them. However, the white male was seen as a more approachable individual, whereas the black female was seen as more of a "hard" individual, sometimes battling to cooperate effectively with the team.

It was evident. Even though both these diverse individuals shared the same habits; e.g. dealing or assisting people, being part of a team and handling conflict; the effectiveness thereof; emotionally; was different. The one (white male) had effective, constructive skills and abilities to deal with these types of situation, where the other (black female) also dealt with these situations but sometimes in an ineffective and destructive manner.

Conclusion

From this case study it can be concluded that people from diverse backgrounds regarding demographics, personality and skills can still share the same habits that can make them effective in a specific working environment. However, these habits are restricted to only output, the effectiveness of the specific output seems to be tied into the degree of emotional intelligence.

Therefore, Shadowmatch seems to be an excellent tool to measure habitual outcomes, and what is needed in a specific work context. These habits can then be built on by using other developmental psychometric tools.

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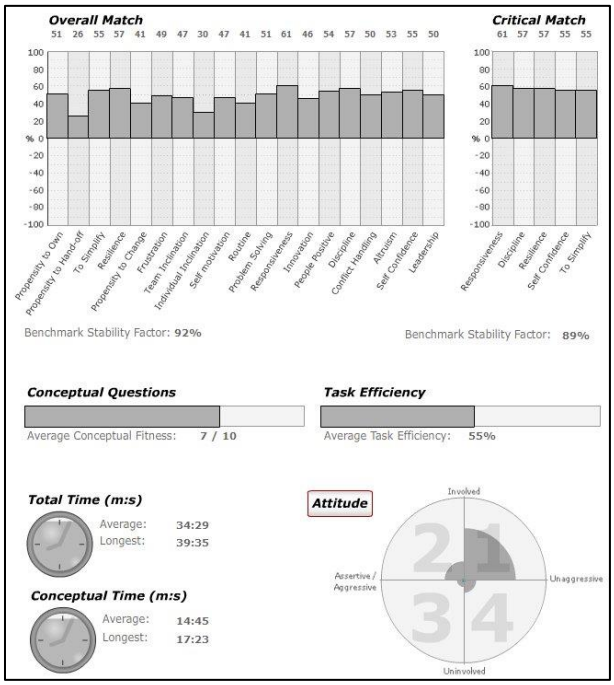
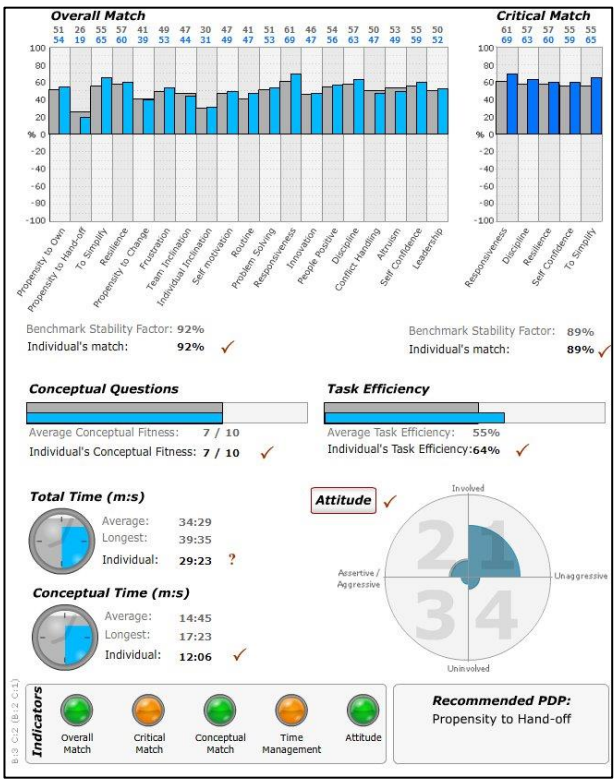
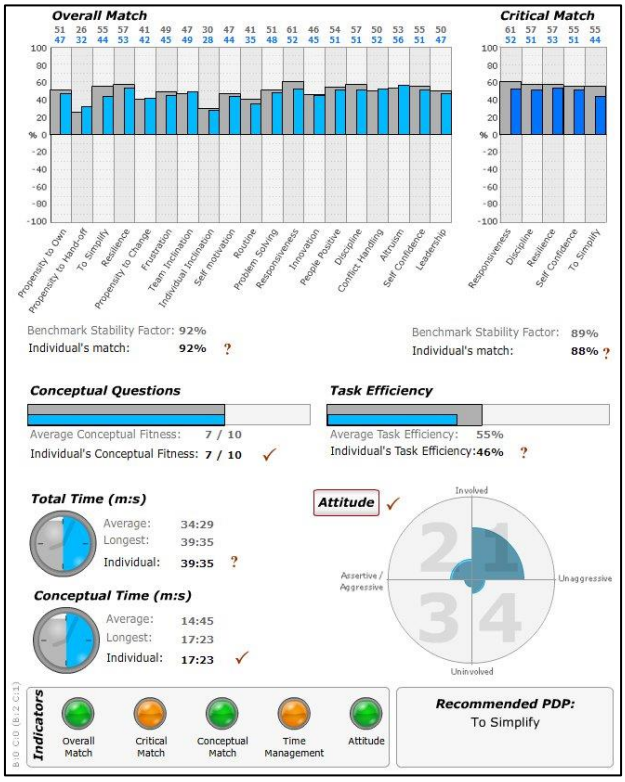






Images (clockwise from top): Benchmark Results, Employee 1 Match, Employee 2 Match

US Department of Labor - Employment & Training Administration

How Shadowmatch supports and complies with the Assessment Guidelines for Employers developed by the US Department & Labor.

What do assessment tests measure?

Employees and applicants vary widely in their knowledge, skills, abilities, interests, work styles, and other characteristics. These differences systematically affect the way people perform or behave on the job.

These differences in characteristics are not necessarily apparent by simply observing the employee or job applicant. Employment tests can be used to gather accurate information about job-relevant characteristics. This information helps assess the fit or match between people and jobs. For example, an applicant's score on a mechanical test reflects his or her mechanical ability as measured by the test. This score can be used to predict how well that applicant is likely to perform in a job that requires mechanical ability, as demonstrated through a professionally conducted job analysis. Tests can be used in this way to identify potentially good workers.

Why do organizations conduct assessments?

Organizations use assessment tools and procedures to help them perform the following human resource functions:

Selection: Organizations want to be able to identify and hire, fairly and efficiently, the best people for the job and the organization. A properly developed and applied assessment tool may provide a way to select successful sales people, concerned customer service representatives, and effective workers in many other occupations.

Placement: Organizations also want to be able to assign people to the appropriate job level. For example, an organization may have several managerial positions, each having a different level of responsibility. Assessment may provide information that helps organizations achieve the best fit between employees and jobs.

Training and development: Tests are used to find out whether employees have mastered training materials. They can help identify those applicants and employees who might benefit from either remedial or advanced training. Information gained from testing can be used to design or modify training programs. Test results also help individuals identify areas in which self-development activities would be useful.

Promotion: Organizations may use tests to identify employees who possess managerial potential or higher level capabilities, so that these employees can be promoted to assume greater duties and responsibilities.

Career exploration and guidance: Tests are sometimes used to help people make educational and vocational choices. Tests may provide information that helps individuals choose occupations in which they are likely to be successful and satisfied.

Program evaluation: Tests may provide information that the organization can use to determine whether employees are benefiting from training and development programs.

General Assessment Guidelines for Employers

Fallibility of test scores

All assessment tools and procedures are subject to measurement errors. This means that a test neither measures a characteristic with perfect accuracy for all people, nor fully accounts for their job performance. Thus, there will always be some errors in employment decisions made based on assessment results. This is true of all assessment procedures, regardless of how objective or standardized they might be.

It is, therefore, important not to rely entirely on any one assessment instrument in making employment decisions. Using a variety of assessment tools will help you obtain a fuller and more accurate picture of an individual. Consider such information as an evaluation of a person's education, work experience and other job-relevant factors in addition to standardized test results.

Appeals process and retesting

Every test taker should have a fair chance to demonstrate his or her best performance on an assessment procedure. However, at times this might not occur. If the results may not be valid for an individual, consider retesting or using alternative assessment procedures before screening the individual.

There are external circumstances or conditions that could invalidate the test results. These may include the test taker's state of mind or health at the time of the test, the conditions under which the test is given, and his or her familiarity with particular questions on the test. To give some specific examples, a person who has a child at home with the measles may not be able to concentrate on taking a vocabulary test. Someone sitting next to a noisy air conditioner may also not be able to concentrate on the test questions. On another day, under different circumstances, these individuals might obtain a different score. If you believe that the test was not valid for an individual, you should consider a retest. If other versions of the test are not available, consider alternative means of assessment. Check the test manual for advice from the publisher regarding retesting. It is advisable to develop a policy on handling complaints regarding testing and appeals for retesting, so that these concerns can be resolved fairly and consistently.

When providing feedback the following should be communicated:

1. Why the test is being administered
2. Fairness of the test
3. Confidentiality of test results
4. How the test results will be used in the assessment process

US Department of Labor: Principals of Assessment

1. **USE ASSESSMENT TOOLS IN A PURPOSEFUL MANNER.**

   Response: *The Shadowmatch system has been specifically designed as a beneficial and positive-oriented system to provide corporations with a way to optimize their workforce.*

2. **USE THE "WHOLE-PERSON" APPROACH TO ASSESSMENT.**

   Response: *Shadowmatch holistically looks at a comprehensive set of habits, behaviors, attitude, efficiency and conceptual measurements broader than all of its competitors.*

3. **USE ONLY ASSESSMENT INSTRUMENTS THAT ARE UNBIASED AND FAIR TO ALL GROUPS.**

   Response: *Shadowmatch drives diversity by specifically NOT focusing on human traits related to ethnicity/gender/etc. Case Studies available.*

4. **USE ONLY RELIABLE ASSESSMENT INSTRUMENTS AND PROCEDURES.**

   Response: *The assessment process has been in use for more than 5 years using a simple and repeatable process. The software environment is hosted and maintains a more than adequate metric of system availability. A formal validation has also been performed and is available.*

5. **USE ONLY ASSESSMENT PROCEDURES AND INSTRUMENTS THAT HAVE BEEN DEMONSTRATED TO BE VALID FOR THE SPECIFIC PURPOSE FOR WHICH THEY ARE BEING USED.**

   Response: *A formal validation has also been performed and is available.*

6. **USE ASSESSMENT TOOLS THAT ARE APPROPRIATE FOR THE TARGET POPULATION.**

   Response: *Shadowmatch is an assessment technique designed to enable managers to make informed decisions about their people and the work they perform. Shadowmatch has been used in Business environments, Sports environments, Academic environments and even interpersonal situations. Since it measures fundamental human behavior it is appropriate in all of these target populations.*

7. **USE ASSESSMENT INSTRUMENTS FOR WHICH UNDERSTANDABLE AND COMPREHENSIVE DOCUMENTATION IS AVAILABLE.**

   Response: *Shadowmatch provides comprehensive and understandable documentation and output within the system, as well as offering online training and other documentation externally.*

8. **ENSURE THAT ADMINISTRATIVE STAFF IS PROPERLY TRAINED.**

   Response: *Online training and onsite support is made available at no charge for all administrative users of the system.*

9. **ENSURE THAT TESTING CONDITIONS ARE SUITABLE FOR ALL TEST TAKERS.**

   Response: *The online survey is readily available and lends itself to all test takers, providing an equal test experience in a fixed or custom environment.*

10. **PROVIDE REASONABLE ACCOMMODATION IN THE ASSESSMENT PROCESS FOR PEOPLE WITH DISABILITIES.**

    Response: *There is currently no offline test available for visually impaired persons.*

11. **MAINTAIN SECURITY OF ASSESSMENT INSTRUMENTS.**

    Response: *The system and results are run and stores in a hosted, secure facility.*

12. **MAINTAIN CONFIDENTIALITY OF ASSESSMENT RESULTS.**

    Response: *The system and results are run and stores in a hosted, secure facility. Also the system uses logon credentials to prevent unauthorized access to test results.*

13. **ENSURE THAT SCORES ARE INTERPRETED PROPERLY AND CONSISTENTLY.**

    Response: *The supporting information and reports generated by Shadowmatch are consistent in their presentation and interpretation of the results. The results are also validated against more than 90,000 internal data points to ensure statistical consistency, and was extensively tested over more than 16,000 test individuals and validated per a formal process.*

11. System Administration

Introduction

The Shadowmatch system can be implemented in large-scale environments with minimal setup and ongoing maintenance. The design of the system provides for a high level of automation, but still requires administrators and users to become certified in its methodology and implementation.

Shadowmatch is a software-as-a-service (SaaS) system that can be accessed online via the internet by administrators, users, and candidates. Since Shadowmatch is delivered entirely through a web based interface, our experience of IT related issues at organizations is relatively low compared to other systems that require traditional implementation. Typical IT related issues that are addressed during initial implementation relate to proper configuration of internet browser settings to allow full access to the system website. Even with different browsers and security settings, the possible configurations are easily identified and typically require minimal IT involvement to setup.

Administrators and users access the system using a secure logon and password that sets their permissions and ability to view different parts of the organization. Candidates (and employees) access the assessment worksheet using a link and unique worksheet code.

Implementation

The following methodology describes the steps that companies will typically go through in evaluation, implementation, and use of the system.

Engagement Phase

The process of educating and informing prospective customers on the capabilities and requirements of Shadowmatch.

1. Demonstration: Customer completes demonstration worksheets; Initial meeting and System feedback & presentation.
2. Opportunity Assessment: Assessment workshop; Data and information analysis.
3. Proposal: Formal commercial proposal; Customer acceptance and sign-off.

Proof of Concept Phase

An optional phase which allows the prospective customer to define a small pilot or Proof Of Concept (POC) to help evaluate the system under more typical working conditions.

1. Execute POC: Project Kickoff; POC Data management (complete worksheets); Create & finalize POC benchmarks
2. POC Evaluation: Management demonstration and feedback; Individual member feedback.
3. Customer Acceptance: POC final results and conclusion; POC Sign-off & Acceptance.

Implementation Phase

The most common approach to the full implementation of Shadowmatch.

1. Training: Conduct Administrator and User training; Provide Administrator access; Provide system access to all system users.
2. Analysis: Identify relevant job areas/departments; Identify top performers by job area/department; Identify current team structures; Identify training needs; Identify the system users and access requirements.
3. Set-up & Data management: Perform System configuration; Create job areas/departments/companies; Create team structures; Issue system codes; Benchmark codes for top performers; Candidate codes for employees or applicants; Data Management; Track worksheet completion; Sort and manage system output.
4. Data Review: Benchmark compilation & Review; Review all job/department benchmarks for stability; Copy individual profiles into team structures; Review stability and performance predictors.
5. Optimization: Precision recruitment; Move & place candidates; Optimize teams; Issue personal development programs; Perform succession planning; Review career paths; Review and resolve conflict situations.

Maintenance Phase

Ongoing support and management of the Shadowmatch system within an organization.

1. Review: Review and update benchmarks and processes; Change management; Monitoring and stabilization.
2. Continuous Improvement: On-going recruitment; On-going team optimization; On-going personal development; On-going succession planning; On-going career path reviews; On-going movement and placement of candidates; On-going conflict resolution.
3. Support: On-going User support; On-going training.

Training

Shadowmatch Training is available through The Shadowmatch University and is web based (with training manual downloads available). A comprehensive suite of training modules training is available and administrators and users are required to become certified by completing the appropriate modules prior to using the system.

Each training module can be downloaded and includes a series of certification questions to ensure transfer of knowledge. The training is made available regardless of whether the assessment execution is handled by the customer.

The following modules are currently available …

1) Shadowmatch Key Concepts (2 hours*)

2) Shadowmatch System Administration (2 hours*)

1) HOW TO LOGIN
2) COMPANY LANDING PAGE
3) DEPARTMENT LANDING PAGE
4) SENDING CODES
5) SENDING MULTIPLE CODES
6) SENDING LARGE NUMBERS OF CODES IN BULK
7) RESENDING/SEARCHING FOR CODES
8) USAGE LIMITS
9) BENCHMARKING TOP PERFORMERS
10) THE SHADOW/BENCHMARK
11) THE SHADOW/BENCHMARK VALIDITY
12) APPLICANT/EMPLOYEE RESULTS
13) INTERPRETING THE RESULTS SCREEN
14) SHADOWMATCH MATCHING REPORT
15) PERSONAL DEVELOPMENT PROGRAMS
16) MULTIMATCH
17) MOVING/COPYING AN INDIVIDUAL
18) PERSONAL FEEDBACK REPORT
19) HELP FUNCTIONALITY
20) RESULTS PAGE FUNCTIONALITY
21) INDIVIDUAL PROFILE INFORMATION
22) INTERVIEW PACKS
23) RECRUITMENT SPECIFICATION
24) SEARCH FUNCTIONALITY
25) COMPANY STATISTICS
26) DATA EXPORT
27) INDIVIDUAL REPORT SELECTIONS

3) Shadowmatch Results Interpretation (4 hours*)

1) WELCOME TO THE SHADOWMATCH UNIVERSITY
2) INTERPRETATION OF THE SHADOWMATCH GRAPH
3) CUT-OFF POINTS
4) BENCHMARK STABILITY
5) INTERPRETATION INDICATORS
6) EXAMPLE 1 – OVERALL HABITS
7) EXAMPLE 1 – CRITICAL MATCH
8) EXAMPLE 1 – CONCEPTUAL, EFFICIENCY, TIME MANAGEMENT & ATTITUDE
9) EXAMPLE 2 – OVERALL HABITS
10) EXAMPLE 2 – CONCEPTUAL, EFFICIENCY, TIME MANAGEMENT & ATTITUDE
11) EXAMPLE 3 – OVERALL HABITS
12) EXAMPLE 3 – CONCEPTUAL, EFFICIENCY, TIME MANAGEMENT & ATTITUDE
13) EXAMPLE 4 – OVERALL HABITS
14) EXAMPLE 5 – PAIRING HABITS
15) EXAMPLE 5 – OTHER HABITS
16) EXAMPLE 6 – PAIRING HABITS
17) EXAMPLE 6 – CONCEPTUAL
18) EXAMPLE 7 – PERSONAL DEVELOPMENT PROGRAMS

4) Shadowmatch Certification (30 hours*)

PHASE 1: Shadowmatch Demonstration Training

1) LOGGING ON
2) SCENARIO #1 – FILL AN OPEN REQUISITION
3) SCENARIO #2 – REDEPLOYING AN INDIVIDUAL
4) SCENARIO #3 - FINDING AN INDIVIDUAL TO REDEPLOY
5) SCENARIO # 4 – MATCHING STAFF FOR AN AD-HOC TEAM
6) SCENARIO # 5 – CAREER PLANNING

PHASE 2: Advanced Results Interpretation

1) INTRODUCTION
2) GENERAL BACKGROUND INFORMATION
3) SHADOWMATCH DEFINITION
4) WORDS TO AVOID
5) KEY SYSTEM DIFFERENTIATORS
6) KEY SYSTEM BENEFITS
7) HABIT INTENSITIES
8) CONTEXT
9) BENCHMARK AND TOP PERFORMER CRITERIA
10) PRIMARY HABIT FOCUS AREAS
11) HABITS ENABLING CULTURE
12) HABITS ENABLING SKILLS
13) CONCEPTUAL FOCUS
14) HABIT CONTEXT, ENERGY, INTENSITY AND ORG STRUCTURE
15) HABIT CONTEXT
16) ENERGY CONSUMED
17) INTENSITY
18) ORGANIZATIONAL STRUCTURE
19) GENERAL WORKSHEET INTERPRETATION GUIDELINES
20) TRAFFIC LIGHTS
21) MATCHING SCORE
22) BENCHMARK STABILITY
23) HABIT SCORES…
24) PAIRING HABITS
25) ADVANCED WORKSHEET INTERPRETATION GUIDELINES
26) ATTITUDE AND STRESS
27) PERFORMANCE IMPROVEMENT
28) DEALING WITH TRAUMA
29) ONE DOMINANT CATEGORY
30) TWO DOMINANT CATEGORIES
31) WORKING UNDER PRESSURE
32) DETERMINE THE POSSIBLE BREAK-POINTS:
33) IMPORTANT POINTS TO REMEMBER
34) BACK CLICKS
35) INTERPRETING BACK CLICKS
36) COMMENTING ON LOW HABIT SCORES

PHASE 3: Team Building

1) TEAM BUILDING OVERVIEW
2) ANALYSIS IF TEAM DATA
3) WORKSHOP DATA REVIEW AND ANALYSIS
4) TEAM PRESENTATION DEVELOPMENT

* Duration includes assessment for certificate of completion

Administration

The organization's proven top performers complete the behavioral assessment worksheet first, and the algorithms in the system then generate the behavioral benchmark of this group, called the Benchmark or Shadow. The benchmark shadow can best be described as the most successful collective capabilities of the group symbolically fit to one theoretical person that would be the best candidate for the job. Next step: anyone within or outside the organization then completes the same Internet-based worksheet, and the Shadowmatch system matches the results against the Benchmark Shadow.

Finally, a full graph is generated to show each candidate's results (in blue) measured against the Benchmark results (in gray). Five types of indicators - overall habits, critical habits, attitude, efficiency and conceptual ability - show the probable risks for success or failure of each candidate. An organization can then make scientifically informed decisions about who to hire and how to train current or future employees. After comparing the results of the Candidate with that of the top performers, the system produce various output reports including:

- Behavioral Assessment results graph - view »Benchmark matching reports
- Personal feedback reports
- Recruitment Specifications
- Interview pack for new hires
- Personal Development programs for employees

When performing hiring assessments the Shadowmatch system can also generate a customized interview pack that contains 10 outcome-based questions. The system selects these questions based on the key habits and behaviors of the benchmark. The interview schedule and interview pack is send through email via the system. The interviewers will input the scores of each question following the interview. The system calculates the average scores and ranks the candidates according to the interview score.

Matching the Results with Shadowmatch

The Shadowmatch system can also allow users to match an individual to many Benchmark groups within the company in order to determine the workplace and job that a specific individual will be most suitable for. This function is referred to as multi-matching. The company can create unique behavioral benchmarks for every working group in the business such as sales, finance, customer care, etc. A current employee or a new recruit or candidate can then be matched against all the benchmarks to determine where the individual will most likely succeed.

By performing employee assessments, the Shadowmatch system can also enable users to take the benchmark of the top performers and search the entire employee database for individuals that already share the habits of the top performers. This functionality provides the user with a list of individuals that could potentially be successful in doing the same job in the same environment or context. The employees/applicants (candidates) who match the benchmark can now be interviewed. This function is referred to as reverse multi-matching.

12. Case Studies

The Success of Precision Recruitment in the Call Center Industry

"A CALL CENTER AGENT IS NOT JUST A CALL CENTER AGENT"

The Scenario

A call center is an operation where professional customer service agents handle phone calls from customers of various businesses. A contact center is a more sophisticated version of a call center. It is an operation where agents communicate with customers through various multimedia including not only the telephone, but also the Internet, email, fax, and so on. The purpose of a call center could be to provide customer service, technical support for products, sales, collection of outstanding debt, or to provide advice. Inbound call centers only take incoming phone calls from customers—usually for customer service or support. Outbound call centers, on the other hand, allow a call center agent to contact a customer—usually to conduct a sales pitch or attempt to collect outstanding debt.

Call centers are very demanding on their employees. This is a disciplined environment where precision control and perfectionism are expected. Call center agents are demanded to deliver perfect calls with every client. Not everyone has the behavioral makeup to handle working in a call center. Staff turnover is a serious problem. A certain company in the financial industry runs a call center with 1,500-2,000 agents. The service provided by their call center agents ranges from inbound customer service in telephone banking, inbound service to assist customers that have a problem with Automatic Teller Machine (ATM) cards, and inbound assistance with regard to the company's web site, as well as outbound calls selling loans, banking services, and so on. This call center provides a wide range of services.

In the call center industry there is a trend to treat call center agents as individuals who are capable of working in any type of call center. One often hears the saying, "A call center agent is a call center agent is a call center agent." In other words, it is assumed that you can use a standard profile to recruit any call center agent for any type of call center in any industry. Currently, call centers use a standard Generic Call Centre Assessment Instrument to recruit call center staff.

This financial company made use of a staffing agency to provide them with call center staff. This staffing agency assessed all applicants with the Generic Call Centre Assessment Instrument. When Shadowmatch was finally brought in to assist with the call center in question; they were battling an annual staff turnover percentage of close to 70%. This was a huge challenge and had a significant impact on the service provided to customers. This constant turnover of their trained, knowledgeable, and competent staff meant that they were continuously recruiting and training staff, only to lose them again within a year. Because of the high cost to train call center employees, if an employee leaves within the first 12-18 months, it is a loss to the business. That employee has not yet started to be productive in excess of his cost to the company. In other words, he has only been a cost; the company has not yet reached the point of break-even on that employee in terms of costs incurred as a result of recruitment and salaries paid calculated against productivity.

Shadowmatch was introduced to the top management team of the call center, and they immediately decided to start using this service for the recruitment of their staff. They identified the top performers in each specific job area and created almost 60 benchmarks (in Shadowmatch these are referred to as “Shadows”)—one for each specific job area. Once all the Shadows were created, they started to match every applicant that was provided by the staffing agency to the benchmark profile of the top performers in each specific job function. Where the call center previously indiscriminately employed all candidates provided by the staffing agency, they now started to review potential candidates against the Shadowmatch shadows, and only placed those candidates that were a good fit. The applicants that did not match were turned away and sent back to the agency.

Shadowmatch immediately enabled this financial company to employ people that were a match to successful performers in one of the divisions. By having the luxury of almost 60 specific Shadows and not just one generic call center profile, they could now precision-place people in the team where they were best suited.

The process produced three distinct results:

1. It allowed the call center management to recruit and place people that had similar habits to the top performers in a specific area of business. This resulted in the new recruits quickly becoming top performers.

2. The ability to precision-place people shortened the training time. Because of the fact that the new employees already shared the habits of the top performers, they immediately fit the team and quickly learned the technical competencies and skills. Upon interviewing some of these new employees and questioning them about their early successes, they said: “These are my kind of people. I feel comfortable working in this environment and in this team.”

3. The call center was able to reduce the annual staff turnover by almost 50%. In a period of ten months, they reduced their staff turnover from 70% to 26%. The precision capabilities of Shadowmatch immediately allowed them to retain their staff for a longer period.

Why is Shadowmatch more effective than a Generic Call Centre Assessment Instrument? The Generic Call Centre Assessment Instrument only measures the “people” aspects of a call center agent. The Generic Call Centre Assessment Instrument has been developed to identify specific attributes that would be fit for any type of call center: People Positive Behavior, Altruism, Conflict Handling, and Team Inclination. However, it does not assess a lot of other important habits necessary to be successful at a particular call center job—for example Time Management, Conceptual Application, Resilience, Propensity to Own, and Propensity to Hand Off.

All call centers are not the same. Specialists distinguish between different levels of complexity in call centers. In some call centers, the job is linear. In other words, the call center agent needs to do very simple and straightforward things in order to provide good customer service. Example: Give a customer a balance on his account.

In other call centers, the job is more lateral. A call center agent might need to take an action in order to provide service to the customer. Example: Transfer funds from one account to another account.

A third type of call center, in terms of complexity, is a conceptual call center. In this type of call center, the service agent needs to interpret what the client says, provide advice, and then take action in order to provide customer service. Example: Give a customer investment advice on money that he has inherited, and then take action in placing the necessary investments.

By taking the above facts into consideration, one can understand that a generic approach toward assessing whether someone is suited for a call center environment would not work. First, because no call center environment is the same, and second, because besides the different complexity levels, one also needs to remember that each call center has a different culture, leadership style, and level of technology sophistication. It is therefore important to take both a holistic and specific approach when assessing whether an individual would be suited for a specific job in a specific call center. Shadowmatch currently provides the only successful answer. Shadowmatch takes each job and the applicant—as well as the environment or context (which includes culture, leadership style, all the different aspects of the working environment, the team dynamics, etc.)—into consideration when mapping the habits of the successful performers, in order to draw a map of what is necessary to be successful in that specific job.

In one of the call centers where we mapped the habits of the top performers, the following results came out as important habits to be successful in the job:

- Propensity to hand off (this was very interesting, as we usually assume that a successful call center agent needs to have a habit of taking ownership. In this call center one of the most critical habits was the propensity to hand off)
- The habit of discipline (this refers to the habit of working in an environment that is regulated by policies, procedures, rules, and regulations)
- The inclination toward teamwork
- The ability to work positively with other people
- The ability to handle conflict
- The ability to work in a routine environment
- The ability to apply one's conceptual ability 30% (the top performers scored 3/10 for conceptual questions. This is an important indicator. Anyone scoring significantly more or less would not be successful in this job)

In addition:

- The top performers completed the Shadowmatch worksheet in an average time of 46 minutes and 40 seconds.

- The top performers also indicated that their dominant approach to their world was one of being involved. They had a tendency to read situations and be un-aggressively involved when necessary, and aggressively involved when the situation asked for it.

All staff appointed in this call center were assessed by the Generic Call Centre Assessment Instrument. They all showed a strong inclination to be positive toward people, had a strong team inclination, and most of them also had a propensity toward taking ownership. (Although, interestingly, it's important to remember that the top performers showed a habit of handing things off!) We assessed a fair sample of staff through Shadowmatch in order to draw a proper comparison as to who would really be successful in this call center.

The following became clear through the Shadowmatch results:

- The call center agents' habits ranged from taking ownership to being able to hand things off.
- The conceptual application ranged from a score of 0/10 through to 7/10.
- Some of the staff displayed a very defined habit of solving problems as well as a very deeply embedded habit of acting immediately and quickly (responsiveness). But the shadow of the top performers indicated that these were not important habits toward success in this call center.
- Top performers completed the worksheet much quicker than the shadow performers. The top performers completed the Shadowmatch worksheet in an average time of 46 minutes and 40 seconds. The time it took the other call center agents to complete the worksheet ranged from 35 minutes and 26 seconds (shortest) to 106 minutes and 45 seconds (longest).
- The agents' attitude (approach to their world) was very diverse. Some staff displayed an attitude of being dominantly uninvolved, but the top performers displayed an attitude of being dominantly involved and unaggressive.

We asked the management team to jot down the names of the average to poor performers. We used Shadowmatch to rank the staff from the best match to the shadow right through to the poorest match. It turned out that only 8 of the 32 staff were really a match to the top performers. According to Shadowmatch, more than 15 of these staff members would not be successful in this specific call center. Upon checking with the management, the names of the average and poor performers that they had jotted down were, with the exception of one name, exactly the same as the poor matches on Shadowmatch. We also learned that some of the staff that proved a poor match to the shadow had already resigned within their first month of employment.

Keep in mind that all these staff members had been successfully assessed by the Generic Call Centre Assessment Instrument and employed with a prediction to be successful in the call center.

Conclusion

Through this exercise, it became clear that one cannot recruit successfully by means of a generic assessment. The assessment used must be specific to the job and the environment. The top performers in an environment need to indicate which habits are necessary to be successful in a specific job. This is the very reason why Shadowmatch has consistently proven to be the best way to precision-employ and precision-develop people.

Case Study: Operations Managers vs. Project Managers in the Mining Industry

The success of any project lies heavily on the shoulders of the project manager, who is expected to deliver the project according to scope, within budget, and on time. These things depend heavily upon the *behavior* of the project manager—not on his intentions or his personality, but specifically on what he accomplishes throughout the lifecycle of the project.

"Good communications and the ability to motivate, lead, and enjoy working with a diverse group of people are the foundation of excellence in project management," according to Stephen Seay, an experienced project manager from Florida.

Shadowmatch was used to investigate the behavioral habits of a group of project managers in the mining industry. In this particular industry, operations managers are often the ones managing projects, because they know the environment well and are adept at managing outcomes. Once the behavior of the project managers was identified, their habits were compared to the habits of the operations managers in the same environment in order to determine which behavioral attributes distinguished project managers from operations managers.

Shadowmatch was primarily used to map the behavioral habits of five top performing operations managers within the gold and platinum mining industry into one combined Shadow (profile). In addition, the behavioral habits of seven successful project managers within the same gold and platinum mines were mapped via Shadowmatch and portrayed as one Shadow. The two sets of results were compared, and are presented in Fig. 1.

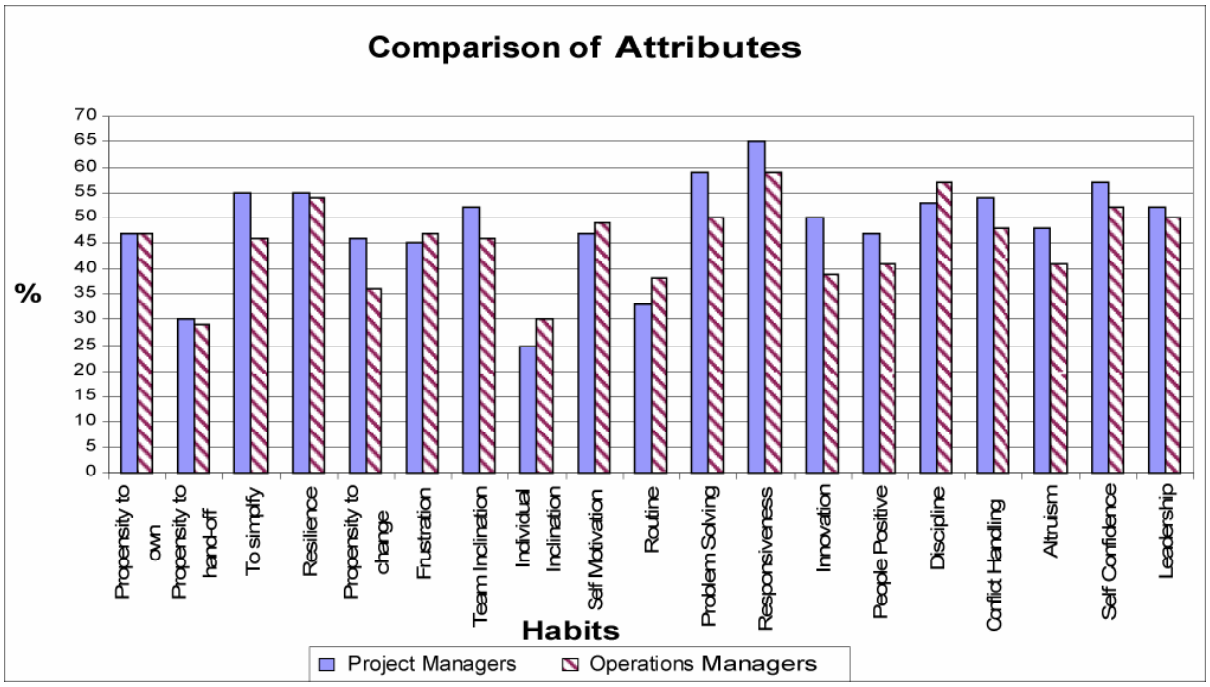


Fig. 1, Comparison of Behavioral Attributes

The significant differences in the comparison between the habits of the operations and project managers led to some conclusions. The project managers tended to participate actively in changing situations and were inclined toward change, if necessary, whereas the operations managers were more reluctant to change. The project managers dealt better with change and preferred working in dynamic environments. There was a 28% difference between the groups in respect to their overall propensity to handle change.

Team and individual inclination are pairing habits, and there was a distinct difference between the average combined profiles. The project managers showed a 33% higher propensity toward teamwork compared to that of the operations managers. The operations managers tended to work well on their own and preferred individual tasks to team tasks.

The project managers showed a 28% higher preference toward finding new and creative ways to perform tasks or to identify new processes, whereas the operations managers in the same environment preferred to stay with the way things were done in the past, rather than looking at innovative ways to approach tasks and processes. The operations managers tended to consider innovation a time waster.

The project managers had a 33% higher propensity to find the correct solution to a problem. However, it took the project managers longer to resolve the conceptual problems. This critical difference indicated that it was of more importance for the project managers to solve problems in their entirety, even if it took more time to do so. The operations managers were more time-efficient but less successful in resolving problems. The habit of successfully applying conceptual ability and the habit of simplifying are “habit pairs.” Both of these attributes were more embedded habits in the behavior of the project managers.

Altruism and conflict handling forms another habit pair, because they combine to form a single behavioral preference. The project managers displayed a 13% stronger tendency in their willingness to help others without expecting anything in return. They also showed a 17% stronger trait in their ability to handle conflict between people in a constructive way as compared to the operations managers. When it came to more people-intensive tasks, the project managers showed stronger developed habits in this area.

Critical Profiles

Shadowmatch creates a critical profile per benchmark group. The critical profile consists of the five strongest habits portrayed by the group from which the combined/average profile has been developed. The critical profiles of these two groups consist predominantly of the same attributes, but in a different ranking order. It means that the way in which the two groups prioritize their behavior differs (see fig 2). Only one attribute between the two groups is totally different. Operations managers displayed discipline as a critical attribute—for example, they were comfortable working in a highly disciplined environment where structure and timeframes were imperative, whereas project managers displayed “to simplify” as their critical habit. They automatically made complicated concepts easier to understand and enjoyed simplifying and resolving problems. The scores in the critical profile of the project managers were higher throughout. This meant that their habits were more strongly embedded overall.

Seven of the 25 habits measured by Shadowmatch have shown a 10% or higher difference between the two combined profiles. Habits that had differences of less than 10% were either insignificant or assumed to be present only when individuals experienced high levels of stress.

Operations Managers		Project Managers	
Attributes	**%**	**Attributes**	**%**
Responsiveness	59	Responsiveness	65
Discipline	57	Problem Solving	59
Resilience	54	Self Confidence	57
Self Confidence	52	Resilience	55
Problem Solving	50	Simplification	55

Fig. 2, Critical Profiles Comparison

Attitude

The two groups did not display significant differences in attitude. Both groups were predominantly participative and unaggressive in their approach toward life and work. Both of the groups became more aggressive when placed in situations where they experienced high levels of stress.

What does this all imply?

There are significant differences in the behavior of successful project managers and operations managers in the mining environment. Project managers have the habit of adapting to change, are team players, and are willing to help others and handle conflict as part of their everyday job. If the operations managers were to handle project teams, the project would probably be delivered on time, according to scope, and within budget, but there would be more conflict between the team members because they tend to be less adaptive to change, more individually inclined, less positive toward others, and less effective in handling conflict situations.

Case Study: In Search of Return on Employment

Employer Overview

Shadowmatch was hired by a 14-year-old organization operating in the medical imports industry. They needed a better way to find successful employees. As a fairly young organization, this company was turning over just short of $50 million, employing 38 people (16 sales, 12 operational and 10 technical), and paying over $400,000 a month before performance bonuses. They had had their share of employment mistakes, and with a customer base of 2,800 medical specialists who, on average, each interacted more than 20 times a year with the business, getting things right with their customers was non-negotiable—so was having the right people on staff. Without a dedicated human resources department, they had been taking their chances contracting employees and looking primarily at outcomes and tasks as a measure of hiring. They relied strongly on performance incentive agreements to motivate their staff. This company hired Shadowmatch, and the following is their successful case study to finding key employees. It's important to note that they did not change the way they managed and incentivized staff once hired.

Pre-Shadowmatch

Recruitment Begins: Pre-Shadowmatch days, following a strong growth period in the company, they had turned to recruitment houses to source key people. Many resumes were forwarded and reviewed. For each job, five candidates were selected and interviewed from at least twenty applications. The resumes each contained impressive skills and qualifications, the candidates were (or seemed) highly successful at their current jobs, and they came well prepared for their interviews. Each candidate had a performance incentive on offer that matched their basic salary. After several interviews, offers of employment were made and final appointments concluded. A fee of 15% of Cost to Company for the year was negotiated with the recruitment agency. A 3-month guarantee was in place so that if that candidate left, the recruitment agency would provide new candidates for no fee.

Training Commences

All new employees were then put through a formal induction process backed by training. The induction program introduced the employee to the company's culture, their staff, their customers, their products and services, their decision-making processes, and the operational environment of the business.

This business supplies highly technical products and services into a market of specialists. It requires study and attention to detail to be fully on top of all the technical aspects. Furthermore, much of their selling is relationship-based selling. Establishing these relationships with clients takes time. Consequently, it would generally take between 2-4 months of training and establishing relationships before candidates reached a Point of Competence (by this we mean the ability to operate independently in the market without direct support of management or a colleague, backed by an ability to deliver against their performance contract.) Up to that Point

of Competence, the company would make a net investment into each new employee. Thereafter, this employee would be in a position to begin covering their cost to the company and generating a positive return. The company would typically invest around 25% of the employee's annual cost to the company in training to develop that employee to the Point of Competence. These costs represented factory, classroom, and on-the-job training.

However, three months into the relationship with an employee—and much investment under their belt—there was often no productivity yet from that employee, as they would have only just reached their Point of Competence.

Performance Management Begins

At this point, the company would begin to aggressively manage the employees via performance contracts against outcomes. These were 3-month rolling agreements with minimum performance requirements (outcomes only) and with incentive targets to reward different levels of performers. Systems would track and report on employee and business performance on a daily basis. For sales staff, that would be total value of sales; for technical staff, it would be percent of technical issues resolved daily and weekly; and for operations staff, percent of originating transactions processed daily and weekly. All staff carried a performance incentive against a customer satisfaction score. Formal performance reviews were held monthly. Poor performers were immediately given additional training if their lack of performance was apparently due to knowledge and/or skills. New product lines resulted in the performance contracts being re-contracted.

Disaster Strikes

Despite the fact that a desire existed by both parties (business and employee) to succeed, all of the agency-recruited staff voluntarily exited from the company between months 5 and 8 due to lack of performance. In short, they did not like the business environment. It was time to take stock. So they did some quick sums and had these shocking insights:

	Description	Measure
1	Recruitment Costs	15% of Cost to Company
2	Training Costs	25% of Cost to Company
3	Average Training Time	3 Months
4	Staff Turnover	30%
5	Staff Turnover Costs	30% * (15% + 25%) = 12% In words, because we lost roughly 1 in 3 people, we had to go through the whole recruitment and training exercise again. To show the recruitment costs against a single picture, we need to include this as a once-off cost. Strictly speaking we should include the full cost of staff turnover. A simple formula can provide this (thanks Shadowmatch). Full staff turnover costs = ([Staff Turnover %] / [1 – Staff Turnover %]) * (Recruitment Costs + Training Costs). The real result is 17.1 %.
6	Costs to Point of Competence	52% (1 + 2 + 5)
7	Average Employee Return per Month (that is whole business)	20% greater than monthly Cost to Company
8	Time to Break-Even	**34 Months** Cost to Point of Competence (6) / Average Returns per Month (7) % * 12 months + Time to Train (3)

Interpretation

This company needed to keep their agency-hired staff employed for a minimum period of 34 months before the business would be in a break-even scenario regarding their employment. However, at the rate agency staff were exiting, their net return on employment was close to negative 100%.

The company could not continue like this. Their growth was being fueled solely by some clever strategies as well as by three top performers in the sales department and two top performers in the customer service division. The returns were being squandered on poor employment decisions. They had to radically rethink their recruitment process. They had to find a way of employing people that were more like their top performers. It was imperative to the continued success and growth of the business.

In Search of Alternatives

They began to search for a better way. It was during this search that they were introduced to Shadowmatch. They learned a few key things about recruiting top performers. Their costly experiences proved to them that "success only materializes when the task at hand, the capabilities and behavior preferences of an individual, and the working environment match so that a person can flourish."

They knew the capability sets they required; they had invested significant management energy into creating a funky and freedom-based work environment; and they were disciplined in dedicating people to tasks. Yet they were nowhere when it came to mapping behavior preferences. They felt recruiting people primarily against their capability sets, their past successes, and their desire to continue being successful was sufficient. They believed these individuals would adapt to and fit into the work environment they had fostered. How wrong they were.

A Strategic Offsite Session with Surprises

It was time for their annual performance review and budget/target-setting process, and they had accordingly booked twelve employees into a weekend offsite session. They decided to experiment with incorporating the Shadowmatch process and mapping the behavior of the people in the business in order to understand if this would give them any insight into employee performance. They had two new employees on hand.

Everyone completed the Shadowmatch questionnaire, and the results were presented in a confidential and sensitive way. Each individual had access to their own results, and the top team had access to everyone's results. The company was in for a shock. In short, these were the rank-ordered results:

Actual Performance against Sales		Shadowmatch Predictor	
Rank	**Sales % of Total Sales**	**Rank**	**Overall Match %**
1	25%	1	92%
2	20%	3	89%
3	19%	2	90%
4	12%	4	85%
5	7%	5	79%
6	5.5%	7	76%
7	4.5%	6	78%
8	4%	8	70%
9	2%	10	63%
10	1%	9	65%

The benchmark group had an internal stability factor of 90%.

What shocked the company was that Shadowmatch could so accurately rank-order actual performance based purely on a behavior map. How was this possible? They realized that behavior (specific to their environment) was a critical success factor for people. Either they had the appropriate behaviors to flourish in a freedom-driven environment, or they did not. They realized they had to begin recruiting for behavior fit as well as candidate skills and good interviewing technique.

Recruitment with a Difference

They immediately commissioned a Shadow per job category and ensured that all potential new recruits were reviewed in Shadowmatch. They also put an incentive structure in place for employee referrals. All candidates were now put through Shadowmatch. These are some of the results obtained against new candidates, using Shadowmatch:

1. The following candidate was employed. Predictably, she now performs to on average 50% of top performer status. Her challenge, as we predicted, is to simplify. If she gets this right, she will without a doubt match top performer status.

2. They also employed the following candidate. He now performs to on average 30% of top performer status. He is very quick-minded and was quick in his behavior map—hence the red score in Time Management. Although a wonderful performer, the company's challenge is to manage his frustration levels. He loses too many deals as a result of frustration—he wants things to happen now. The behavior map of the top individuals indicates clearly that patience and perseverance is required for success.

3. This next individual was employed pre-Shadowmatch days. He barely covered his cost to company but has a wonderful attitude, so was well liked. Unfortunately, he has since left the company in his and the business's best interests. He is far more successful at his subsequent job.

Determining Return on Employment

After 12 months using Shadowmatch and witnessing the continued growth of the business, the company decided to re-benchmark the Return on Employment Numbers. They were in for pleasant results relative to their pre-Shadowmatch days.

	Description	Measure
1	Recruitment Costs	7% of Cost to Company
2	Training Costs	13% of Cost to Company
3	Average Training Time	< 3 Months
4	Staff Turnover	10%
5	Staff Turnover Costs	10% * (7% + 13%) = 2% Full staff turnover costs = ([Staff Turnover %] / [1 – Staff Turnover %]) * (Recruitment Costs + Training Costs). The real result is 2.22%.
6	Costs to Point of Competence	22% (1 + 2 + 5)
7	Average Employee Return per Month (that is whole business)	50% greater than monthly Cost to Company on average (up from 20%).
8	Time to Break-Even	**6.78 Months** Cost to Point of Competence (6) / Average Returns per Month (7) % * 12 months + Time to Train (3)

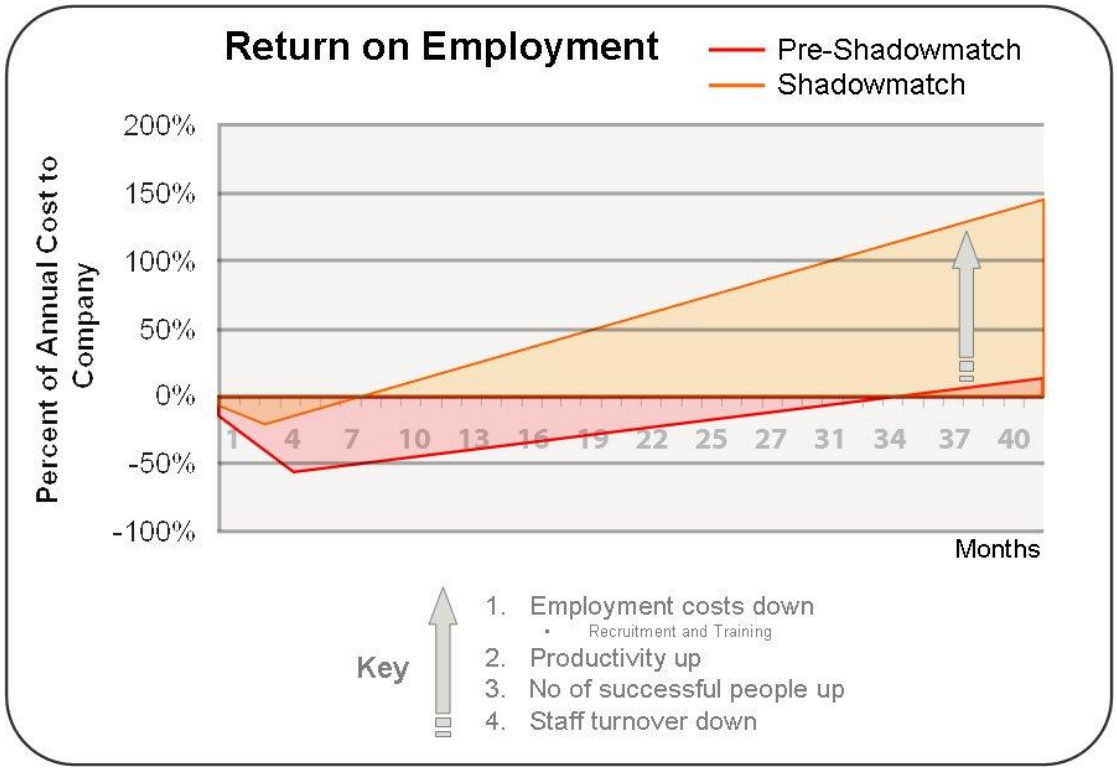
They have gone from a break-even scenario of 34 months to under 7 months. In other words, they recover their investment in each individual, on average, by month 7. They are delighted with the results and the impact it has had on the business. It represents a five-fold improvement in their employment practices (34.2 ÷ 6.78).

Conclusion

Their top performing people provide much more value to the company than poor performers, so finding successful people is imperative for their continued growth. Shadowmatch has shown that recruiting people for their behavior preferences (as benchmarked against a top performer Shadow) is far more effective than their

traditional recruitment methods were. Their average productivity levels are up and their time to break-even on employment is one fifth of what it was previously. Their staff turnover is also a fraction of before. In other words, they avoid costly employment mistakes. For the first time, they are in a position to recruit people scientifically against a top performer benchmark that has fully captured the behavioral habits of top performers given their specific work environment and the tasks at hand.

Finally, the impact on their business is shown visually:



A final comment on Shadowmatch

This company has now been using Shadowmatch for a significant period. The staff turnover has dropped to 5%. Their culture is far more stable than ever before. Their people share common behaviors to a very high degree, and this is helping the business succeed.

They have had some strong challenges to deal with in the market. Their top performers have been offered double their basic salaries at other companies—yet they remain in place, citing the work environment as being a benefit that no competitor can match. Shadowmatch has given them a direct handle on being able to manage the behavior content of their working environment.

People work with people they relate to. Shadowmatch continues to make a big difference—to the business as well as the success of the company's staff.

Their employment costs are down in both recruitment and training, their productivity levels are up, the number of people successful in the business is up, and their staff turnover is down.

Case Study: 'Shadowmatching' A Golf Team To The Trophy

Introduction

Shadowmatch has proven its worth as a tool that assesses individuals in terms of their habits, and then interprets how to best use and develop these habits to the benefit of the individual and the organization. Long gone are the days when individuals worked alone and isolated. It's crucial for employees to be compatible in order to ensure the smooth-running success of the operation.

As a tool, Shadowmatch measures parameters such as team inclination vs. individual inclination, along with attitude scales that indicate the propensity of employees to act as contributing members of a team. Shadowmatch is adept at contributing to the success of highly functioning teams.

It's interesting to note that a recent focus of industrial psychology has been on maximizing the potential of work teams and assembling these teams in a more productive and efficient manner. Although not historically commonplace in industrial psychology, teams and teamwork have been studied in sport psychology for quite some time. Improving teamwork is one of the most important tasks sport psychologists are often given.

With this in mind, Shadowmatch provides a great tool to the field of sports. When presented with the opportunity to get involved in the psychological testing of an under-19 golf team, we jumped at the chance to prove our metal.

This golf team, under the guidance of its manager, had the ultimate goal of becoming national champions. After having seen the Shadowmatch system, the manager and the executive committee of the golf foundation felt that Shadowmatch would be the secret weapon that would differentiate them from some stiff competition. At the end of the process, this thinking proved right, and the team did in fact become the National Under-19 Golf Champions.

How we reached this success was an intricate and detailed process, outlined in the case study below.

Case Study

The team involved in the testing was an interesting mix of age groups, experience levels, and personalities. The team would be made up of nine players, eight of whom would play per day. These players would compete against eleven other teams over five days for the title of National Junior Champions. This is an extremely important tournament on the road to becoming professional golfers.

Five players from this team had competed internationally. However, all the other players from the pool of possible selections had not yet played international junior golf, and this presented the team manager with an interesting challenge. Excluding the obvious factors of skill level and form, how do you match five players of immense experience with four players of very limited experience and still have them work well as a team?

Shadowmatch was used to compare these players of differing experience levels in an equitable way. In sport, this is often referred to as "getting the mix right between youth and experience." By incorporating Shadowmatch into the team selection process, the manager did in fact get this mix right—not only in an intuitive way, but also by using science with valid and reliable results.

Testing process

This group of golfers was made up of nine members who were all teenagers, and who ranged in age from 16 to 19. Subjects from this age group generally resist and are apprehensive about being analyzed or tested, which created a level of difficulty in the testing. To break this resistance, each player was given his Shadowmatch code and allowed to perform the assessment at home over the Internet.

This was not a compromise, but a strategic decision. By not conducting a centralized assessment, players didn't have the opportunity to compare notes, which meant that there was no chance for them to feel inferior or "wrong" in their answering. Also, by allowing the players to take the assessment at home, we ensured that they would be more comfortable and thus less anxious. And because they were able to use their own home computers, there were very few administrative glitches during the testing phase.

The group of players selected was actually an ideal team for computer- and web-based testing. All of the players either had their own personal computers or had a family computer at home, and were thus very comfortable with using computers. Once again, this decreased much of the normal anxiety experienced in testing because the players were using a medium they were comfortable and familiar with.

Once the assessments were complete, each player received his two-page report. Indirectly, this report helped to create an early positive self-regard within each player. Their strengths were highlighted, putting them (and their parents) in a positive frame of mind toward the test and, more importantly, toward the sport psychology process that was to follow.

Results

After studying the results of the testing, the following patterns proved to be the top five habits of golfers in this group: responsiveness (the ability to react quickly), simplification, self-confidence, resilience, and discipline.

In many conversations with the team's manager as well as the Shadowmatch team, it was interesting to note that one of the most important qualities of these golfers was thinking habits (otherwise known as golf course management skills).

Critical Habits

Surprisingly, the habits of responsiveness and the ability to simplify are two of the important abilities of the most successful golfers of all time. Why?

Upon close study of this team and successful golfers of the last three years, it was easy to see how responsiveness could be a critical skill for success on the golf course.

Responsiveness is the ability of a person to think on their feet and to react quickly. This needs to happen on the golf course, where conditions can change in a matter of minutes. The ability to successfully adjust and respond to a changing environment over a 6-hour golf tournament is therefore a large key to success.

In addition, if they possess the skill of being able to simplify, successful golfers avoid the propensity to suffer from what is jokingly referred to in golfing circles as “paralysis by analysis.” Simply put, when a golfer has too many conflicting ideas in his or her head about strategy, he might never come to the conclusion of actually hitting the ball. In being able to simplify a problem or challenge, these successful junior golfers are better able to get positive results. They tend to not over-think the information presented to them by yardage books, caddies, sensory input, and their past experience. They have developed the positive habits of thinking and reacting quickly due to time constraints, and they do this by only working with what they perceive the essence of the problem to be (in other words, simplifying).

Here’s an example: When faced with very long putts, this group universally focused on only two factors—the pace of the putt, and getting it as close to the hole as possible. On a 30m putt, there are many factors to consider when aiming the ball to the hole. Players could think about slope, speed of the green, pin placement, input from the caddy, type of putting stroke needed, power on the stroke, visualization techniques, and a myriad of other potential data. But these players had learned to cope by using the habit of simplifying their process and focusing on only two potential aspects.

Whereas responsiveness and simplification are course-directed habits, the other three critical traits of this group proved to be more internally directed.

Self-confidence is a universally valuable skill that any person who is trying to perform in any environment at any level must have in order to succeed. In this particular group, the trait of self-confidence resulted in a team dynamic that was self-assured without being arrogant, and a belief that no matter how tough the situation, the team could rise above the challenge.

This indeed proved to be the case when the team lost one of its games on the second day of the tournament. Instead of the team disintegrating or a developing a negative vibe, all the players pulled together with a sense of confidence and made a promise to one another to not lose one more game—something they in fact achieved quite easily.

This tournament also tapped into the players’ common trait of resilience, a trait that is not only imperative in a tournament environment, but in golf in general, where players are inherently faced with more disappointment than success. Tiger Woods, the world’s number one player, wins only roughly every four tournaments he

enters—a very poor success rate if one takes into account that golf is his livelihood. From a young age, players learn the ability to bounce back after disappointment on the course. This is needed if one is to play top amateur golf or even just return for a next round after the disappointment of a bad round.

The last trait this group shared was discipline. If one looks at the sport of golf from the outside, one is struck by the utter discipline needed to compete at a top level. This does not only include discipline to practice the various important skills of the game, but also the mental discipline needed to put together a successful round after having played badly the day before. Discipline is a bedrock rule of the game. Players will often mark their own scorecards, and if a player is not disciplined or honest in his scoring, he can be a liability to the game and to the team.

Conceptual ability and attitude scale

When tested for conceptual ability, this group of junior golfers achieved an average combined score of six out of ten. This is a high score for their age group, and it's postulated that this is due to the nature of the game of golf. When these players engage in a game of golf, their conceptual ability is consistently tested and developed to a higher degree. In golf, various forms of information are given to a golfer on the course before he plays each shot. These include how long the hole is, how far the player is from the green, which club will allow the player to hit the best shot, what external influences (such as wind) are present, and how they will affect the shot.

The player needs to take all of these factors into account before selecting a club and playing each shot. This sort of conceptual ability asks the player to look at the available data, re-work it using their own frame of reference, and then solve the problem to the best of their ability. Players with a higher conceptual ability are generally more successful on the course, because it allows them to make more informed decisions and to better execute their preferred solution.

On the attitude scale, players tested predominantly within the first quadrant. This means that this particular group of golfers were predominantly involved and unaggressive in their approach to their world and relationships. All of the players interacted predominantly in this way, so there were very few altercations during the week of the tournament and in the weeks leading up to the competition.

This made the sports psychologist's job much easier and also made the interaction of the manager with the players a lot less strained, allowing the players to cope more successfully with disappointments and to work together when challenged.

Teambuilding

In the lead-up to the tournament, time was spent analyzing the combined Shadow of the team. This was done to show the team its strongest traits, but also areas where they didn't display such strong traits. This made them aware of how they looked as a team. At this stage, no individual results were made available in order to ensure that players did not face criticism from teammates if they did not match up to the Shadow, and that players who were a good fit to the Shadow did not look down on the other teammates. This was done purely as a teambuilding exercise, where all the players were made aware of strong team habits and areas where they did not display strong habit patterns.

A lot of hard work was put into the testing and the development phase of this team's existence, but the question still remained: What would the players do in the heat of battle? Well, they did exactly what Shadowmatch had predicted, and everything went according to plan.

Results in the tournament

Statistics on this tournament indicate that the team involved won 92,5 out of a possible 132 points against eleven other provinces over five days of competition. That equates to a win ratio of 70% in one of the toughest inter-provincial tournaments on the golfing calendar. The team had six of its players chosen for national squads at the end of the tournament, and lost to only one other team by the slim margin of one point. Statistics, however, do not tell the whole story.

What really differentiated this team from the rest was how they dealt with disappointments and challenges throughout the week. This became very apparent when the team lost on the second day. This loss was only by one point, but it could have been the end of the tournament. However, true to the predicted habits on Shadowmatch, the team did two things that ultimately ensured their success: they pulled together as a team, and they kept their involvement un-aggressive.

The golfers in the team were tested as predominantly team-inclined, and this shone through on the day they lost. The evening after the loss, the team and their captain set the target of not losing one more game. They achieved this with distinction. At no stage did any of the players become problematic in their behavior, and it was extremely interesting to see how, after the loss, the team seemed to gel even more and went on to perform to their true potential.

Conclusion

The concept of an efficient and productive team is relevant regardless of an industrial or sports related environment. The benefits of discovering and leveraging behavioral strengths to the maximum advantage of the team provides tangible results in all settings.

Shadowmatch has been used extensively in the industrial setting that include many different teams and groups. In addition, it has now proven successful in mainstream sport, helping a team of aspiring young golfers win the national championship they had been striving for.

13. Conclusion

Shadowmatch is a system born from the passion and curiosity of individuals trying to solve a simple yet challenging question of what makes people successful. The extensive research and analysis that followed reviewed existing theory and pioneered new areas of behavioral study in order to answer this question.

The new areas of humanistic study around behaviors showed quite clearly that habits rather than personality prove to be a more effective and reliable predictor of success relative to top performers. Behavior also provides more tangible and actionable information for teams to work together more successfully and for individuals to be more precisely developed and coached in meaningful ways.

A responsible and committed team of professionals from industry and academia performed the validation of the initial system and its concepts to ensure the system was appropriate for use in environments. Additional analysis and case studies have been created to show that the system also works without an adverse impact against protected classes of race, age, gender, etc.

Since its inception, Shadowmatch has been applied in many different environments and proven itself to provide extreme value to organizations to help build better teams, develop and manage individuals, and to recruit and redeploy with a high degree of precision.

The implementation of Shadowmatch is scalable and repeatable with a simple and elegant methodology that allows organizations to become trained and certified in the rollout and administration of the system.

In summary, we believe Shadowmatch fills a unique space in the marketplace: it is the only proven system of its kind that has been developed with a ‘positive impact’ philosophy to effectively answer the fundamental question of employee success through behavioral benchmarking.