The Valence Illusion

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According to Kurt Lewin, a person's behavior (B) is the function of the person (p) and his or her environment (e), $B = f(p,e)$, meaning that every behavior (or work) of one person can never be attributed to the person alone, but always to the person interacting in a (social) environment. This is very much true for my dissertation.

In this sense, I want to thank my mother, my father, and my brothers for always being supportive, no matter what path I would choose. Without your help, not a single line could have been written.

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Abstract

The valence illusion hypothesis is developed and states that valence acts as superordinate dimension in impression formation. Valence biases the judgment of perceived characteristics of other human beings. Evaluative Conditioning (EC) is a procedure to isolate and manipulate valence directly and was used in seven experiments to produce desired valence effects. Three experiments were devoted to the question whether EC procedures can account for valence effects in impression formation. Photographs of persons were conditioned with either positive or negative valence. Altering the photographed persons slightly (e.g., adding glasses) after the conditioning phase simulated everyday change in appearance of human beings. Four additional experiments investigated the proposed role of valence in impression formation. In the evaluative rating phase, participants were asked to rate the portrayed persons on a total of ten different characteristics, all of them belonging to the big two of impression formation, agency and communion. Evaluative Conditioning affected valence ratings on altered photographs, and valence did influence the perceived characteristics of photographed human individuals on all tested characteristics. Furthermore, the size of the valence effect can be predicted by the conceptual similarity of one characteristics to likability. Implications and avenues of future research are discussed.

Zusammenfassung

Das Framework der Valenz Illusion wird erarbeitet und stellt die Hypothese auf, dass Valenz eine übergeordnete Dimension im Bereich der Eindrucksbildung darstellt. Valenz führt zu einer verzerrten Bewertung von Eigenschaften anderer Menschen. Evaluatives Konditionieren ist eine Prozedur um Valenz zu isolieren und zu manipulieren und kam zu diesem Zweck in sieben Experimenten zum Einsatz. Drei Experimente haben dabei untersucht ob Evaluatives Konditionieren dazu geeignet ist, Valenz-Effekte in der Eindrucksbildung von Personen erklären zu können. Portrait-Fotografien von Personen wurden mit entweder positiven oder negativen Stimuli gepaart, wobei Veränderungen in den Stimuli Änderungen von Personen im Alltag simulieren sollten (z.B. das Tragen oder Weglassen von Brillen). Vier weitere Experimente haben die postulierte Rolle von Valenz als übergeordneter Dimension in der Eindrucksbildung untersucht. Nach der Konditionierungsphase wurden die Probanden gebeten die portraitierten Personen auf insgesamt 10 unterschiedlichen Eigenschaften zu bewerten. Evaluatives Konditionieren beeinflusste die Bewertung für alle 10 Eigenschaften. Die Größe dieses Valenz-Effektes kann durch die konzeptionelle Ähnlichkeit einer Eigenschaft zur Eigenschaft „Sympathie“ vorhergesagt werden. Implikationen und Hinweise für weiterführende Forschung werden diskutiert.

Table of Contents

1. Introduction

The first chapter aims to give the reader a broader perspective on the rich literature on research of related concepts. This comprehensive overview leads then to the reasoning of my specific hypothesis that was investigated thoroughly, namely the valence illusion hypothesis. In order to do so, I will briefly summarize past research on forming impressions, Cognitive Illusions and Evaluative Conditioning. Afterwards, I will lead into my specific hypothesis and describe every conducted experiment in great detail. This dissertation will end by discussing the results thoroughly and putting them into the context of the existing literature.

The chapters on impression formation are largely inspired by Uleman's and Kressel's (2013) excellent summary of the history of theory and research on impression formation. I do not want to take any credit for the large amount of work they were putting into identifying and putting together all the work researchers have done in the past 100 years. Instead, the goal of these chapters was to select the pieces that are related to my very own research question in order to give the reader a better understanding of how my research question fits into the large body of already existing research. The same is true for the chapters on Cognitive Illusions, which are inspired by the book *Cognitive Illusions: Intriguing phenomena in thinking, judgment and memory* (Pohl, 2017). The evidence reported for Evaluative Conditioning is largely inspired by a meta-analysis conducted by Hofman, De Houwer, Perugini, Baeyens, and Crombez (2010).

1.1 Impression formation

In order to survive, people need to judge their environment carefully, and one aspect of the environment are other people. Who is this other person? Does he or she want to harm me, or do me good? And does he or she have the abilities to do so?

Unsurprisingly, the research on how we form our impressions of other people has a long tradition, and some of the most known advancements in psychological research stem from this area.

The terms *impression formation* or *person perception* refers to processes by which individual pieces of information are used to form a global impression of the target person. Maybe the biggest problem that has plagued researchers from all over the world is the problem of accuracy in impression formation. Which piece of information leads to an accurate description of one's personality, and which leads to a bias? And is there such thing as an objective way of describing one's personality?

1.2 Accuracy in impression formation

As will be seen, people's perception of others can be very diverse. While one can describe a stone objectively (e.g., color, weight), there is no objective standard for impressions people leave on others. In fact, what we see in others depends largely on assumptions and feelings (e.g., Uleman, Saribay, & Gonzales, 2008).

Uleman and Kressel (2013) gave an excellent summary of the history of theory and research on impression formation: In the earlier years of the 20th century, the measurement of subjective phenomena such as impression formation began to make progress. While Likert (1932) introduced his scaling, Thurstone (1928) published the method of paired comparisons for measuring attitudes. These and other related methods allowed researchers to observe subjective phenomena in a quantitative manner, increasing the acceptance of such research. Asch (1946) focus on traits enabled him to identify two central traits that are often used up to this day (warm, cold) when a person's personality should be described. He showed participants fictional target people with lists of traits and asked the participants to form an impression. He found that out of all tested traits, warm and cold were the traits that had the biggest influence on participants freshly formed global impression. Luchins (1948) criticized Asch's (1946) experiments, arguing that these artificially achieved effects "may achieve experimental neatness" (p. 325), but would only do so by neglecting important factors that contribute to the impression formation in a real-world context (e.g., individual and situational contexts). In 1955, Cronbach published his classic critique on accuracy research in impression formation, demonstrating that many of previously reported findings may be nothing more than statistical artifacts. Because his methodological concerns were so fundamental, research on accuracy in impression formation disappeared until 1987, when Kenny and Albright revived it. By summarizing the difference between subject and object perception, Kenny described the root of the problem that plagued the research on accuracy in impression formation quite well: "First, person perception is two-sided: Each person is both perceiver and target. Second, …. perceivers attempt to read the minds of targets and engage in what is called ´meta-perception`. Third, … there is a close linkage between self- and other perception. Fourth, … people, unlike objects, change when they are with different interaction partners" (Kenny, 1994, quoted in Uleman & Kressel, 2013)."

As can be seen, accuracy in research on impression formation is hard to achieve, even in laboratory settings.

1.3 Possible structures underlying impression formation

Besides the problems of accuracy, researchers wanted to find out possible structures and processes underlying impression formation. A prominent approach are associative memory networks, an idea borrowed from cognitive psychologists (e.g., Anderson & Bower, 1973). In associative memory networks, mental structures are described as nodes, connected to each other by links that transfer activation or inhibition. Nodes become linked to each other when they are activated together (contiguity). Therefore, nodes that were linked together by activation form a structure of associated concepts. Bruner (1957) described how activation increases a concept's accessibility. Higgins, Rholes, and Jones (1977) published their classic studies of the fictional Donald. Participants were first primed with a concept (reckless versus adventurous) and then shown an ambiguous description of a fictional person called Donald. After this procedure, participants were more likely to describe Donald in the direction of the primed trait. The frequency and the recency of the use of a concept both increases the accessibility of the concept (Higgins, Bargh, & Lombardi, 1985).

In a different line of research, Rosenberg, Nelson, and Vivekananthan (1968) were also concerned with the structure underlying trait impressions, which led to implicit personality theories (e.g., Rosenberg & Sedlak, 1972), and extracted two main dimensions, similar to Asch`s (1946) warmth and cold dimensions. Judd, James-Hawkins, Yzerbyt, and Kashima (2005) labeled the warmth and competence dimensions identified by Rosenberg et al. (1968) as the "Big Two", because they build the foundation of many theories on impression formation, for example the stereotype content model (SCM; Fiske, Cuddy, Glick, & Xu, 2002) or its elaboration, the behaviors form intergroup affect and stereotypes (BIAS; Cuddy, Fiske, & Glick, 2007) map. Even though the label of the Big Two can vary from one line of research to another, they are very similar in their conceptualization. The warmth dimension (often labeled as *communion*) describes how warm, friendly and well-intentioned one person is, while the cold dimension (often labeled as *agency*) describes how dominant, potent, and influential the person is (Fiske, Cuddy, Glick, & Xu, 2002; Abele & Wojciszke, 2014).

1.4 Valence and the Big Two

Approximately in 1980 social cognition had emerged as a “new” approach to social psychology, and it highlighted research on understanding processes rather than only outcomes. Among other things, the focus on processes gave valence a headline on the front page of impression formation. In Anderson’s (1965, 1974) information integration, weighted averaging model, evaluative dimensions that described a target were averaged in order to predict an overall impression. A typical finding of this is that negative traits were given more weight in the average by participants than positive traits. Skowronski and Carlston (1989) explained these findings in their category diagnosticity approach. They argue that cues such as traits have more weight if they offer a better diagnostic of the to be judged dimension. They define diagnosticity as the reduction of uncertainty in choosing among responses. Building on the arguments of Reeder and Brewer (1979), they added that the diagnosticity depends on the domain. A good (versus bad) performance (positive valence) might be more diagnostic for the domain of abilities, because everyone can have a bad day. Immoral behavior (negative valence), on the other hand, may be more diagnostic then moral behavior for the domain of morality, because, so the reasoning, even evil people might act good sometimes. Baumeister, Bratslavsky, Finkenauer, and Vohs (2001) and Rozin and Royzman (2001) simultaneously showed that negative events have more weight than positive events in many ways. They concluded that negative events are more potent then equally positive events. The negativity increases more rapidly in space and time, they dominate positive information when integrated, and they are more differentiated and complex (Unkelbach, Fiedler, Bayer, Stegmüller, & Danner, 2008).

Positive and negative valence are not only weighted differently, there are also differences in the processing of the information. Pratto and John (1991) demonstrated that negative information leads to higher incidental memory and attracts attention automatically more than positive information. Abele and Bruckmueller (2011) showed that communal traits (similar to warmth) were recognized faster than agentic traits (similar to competence) in a lexical decision task and were faster categorized by valence. This is in line with De Bruin and Van Lange’s (2000) finding that people find communal (versus agentic) information as being more diagnostic when they want to learn something about a potential future interaction partner, and they also did spend more time reading the communal information.

As a short summary, people need to judge their social environment, but accuracy in these judgments is hard to achieve. Nevertheless, two main dimensions have been identified, agency and communion. Valence seems to play a significant role in these judgments, but the focus of past research has been on valence differences for positive and negative valence. The causal effect of valence itself has not yet been the target of investigations in impression formation research.

1.5 Cognitive illusions

When accuracy is hard to achieve, errors will be made. In fact, humans continuously make errors when it comes to thinking, judgments and/or memory. There are many phenomena that show that subjective memory, thinking, and judgment differ from objective measures. As an analogy to the better-known field of "optical illusions", the term "cognitive illusions" has been used to describe a certain set of human errors (Roediger, 1996).

Pohl (2017) identified five points to distinguish cognitive illusions from other forms of typical errors: *First* and most importantly, illusions lead to a perception, judgment, or memory that reliably deviates from an objective reality. For optical illusions, subjective perceptions and objective stimuli can be compared, and thus, the illusion can be easily measured. Unfortunately, this is much harder to do in the domains of thinking and judgment. The problem lies in the definition of what "correct" thinking or judgment is (Gigerenzer, 1996). *Second,* this described deviation from reality must be a deviation in a systematic rather than in a random fashion. *Third*, cognitive illusions appear involuntarily, meaning that they will appear spontaneously and without any instructions or deliberate will. This does not exclude any motivational factors as they do moderate the size of cognitive illusions, but they are not the ultimate cause of it (Pohl, Bender, & Lachmann, 2002). Illusioned people often do not realize that they have been blinded by an illusion (Gigerenzer, 1996). The *fourth* point to distinguish cognitive illusions from other errors is that the illusion is hard if not impossible to avoid. By manipulating instructions, material, and/or other procedural variations, some researchers have reduced or even eliminated some cognitive illusions (e.g., Gigerenzer, Hertwig, Hoffrage, & Sedlmeier, 2008), but for other illusions these attempts have failed (e.g., Pohl & Hell, 1996).

As the *fifth* and last point cognitive illusions do stick out as something special and rather distinct from the normal course of information processing. Cognitive illusions pique our curiosity (Roediger, 1996) by seeming to be somewhat different, and thus, motivates us to explain these unexpected but robust findings.

As described earlier, the term cognitive illusions relates to certain errors in the domains of memory, thinking, and judgment.

Memory illusions are typically errors in the recall or recognition of earlier presented material. One famous case is the so-called hindsight bias, which describes a tendency in which people exaggerate what they knew in foresight. For example, after knowing the result of a basketball match, people were too convinced that they would have predicted the winning team beforehand (Pezzo, 2003).

Illusions of thinking are those errors that are made when certain rules have to be applied (e.g., falsification principle, logic). These results can be derived from normative models and their results can serve as a benchmark against which human performance is evaluated. One common illusion of thinking is the illusion of control (Langer, 1975). It occurs when people overestimate the amount of control they have over an outcome. Thompson and colleagues (2004), for example, showed participants either a red "O" or a green "X". They were told that they could choose to press or not to press the space bar in order to get the green "X". Even though the software was programmed in such a way that pressing or not the space bar had zero effect on the occurrence of the desired letter, participants were still convinced they had control over the outcome.

The third category of cognitive illusions are illusions of judgment. In many experimental settings, the participants task is to subjectively rate a specific aspect of a given stimulus (e.g., liking). In some cases, other aspects inside of the experimental setting may bias participants judgment in a systematic fashion, for example a neutral stimulus might be perceived as more pleasant to the eye when presented simultaneously with a pleasant melody. It is important to note that these judgments have to be made under uncertainty, meaning that participants can rely on subjective impressions, only (Pohl, 2017). Illusions of judgment include well known phenomena such as the anchoring effect (Tversky & Kahnemann, 1974) or the mere exposure effect (Zajonc, 1968).

Maybe the most interesting illusion of judgment, concerning the current investigation, is the halo effect (Thorndike, 1920). The halo effect is a cognitive bias that describes a tendency of judges to assume that once a person possesses some known good (or bad) characteristics, their other, unrelated and unknown characteristics are also likely to be consistent, that is, good or bad (Forgas & Laham, 2017). One of the most prominent halo effects can be observed when participants are asked to judge certain characteristics of physically (un)attractive people. Even though participants were not given any direct information about any sort of character traits, participants are likely to believe that physically attractive persons possess more positive character traits then physically unattractive persons. This tendency is often labeled as what-is-beautiful-is-good (Dion, Berscheid, & Walster, 1972; Eagly, Ashmore, Makhijani, & Longo, 1991). Negative halo effects do also exist and are often termed the devil effect or the horns effect, in which a single negative attribute can lead to a negative bias on unrelated other characteristics. Conceptually, these halo effects are similar to other kinds of constructive cognitive illusions characterized by a general confirmation bias (Forgas & Laham, 2017). Halo effects are known to influence a wide range of social judgments but are mostly studied in the domain of impression formation.

In their classic experiment, Dion and colleagues (1972) gave participants a set of photographs showing young women, which were classified beforehand as attractive, average, or unattractive. Participants task then was to rate these women on a wide range of characteristics. It is interesting to note that this task is somewhat unfair, because there was no information about their personalities given. Participants, however, performed the task regardless, and they could only do so by relying on the physical appearance showed on a photograph. As a result, participants rated the attractive women as having better personalities, to be happier, and more likely to marry. As a little surprise, the average looking women were rated as more competent parents. This outcome was commonly interpreted as a demonstration, that halo effects do not spread to any given attribute equally but is moderated by the content of the to be judged dimension.

These halo effects do not only appear in the laboratory, but have consequences in the real world, because once an initial expectation about a person is formed, they can become self-perpetuating with consequences about how a person is treated (Harari & McDavid, 1973). Landy and Sigall (1974) reported that the same essay would be rated more positively when the writer is an attractive rather than an unattractive woman, and this effect was even stronger for bad (versus good) essays. Dion (1972) found evidence that unattractive children were more held responsible for breaking rules then attractive children, and that these rule breaking is perceived as being more likely to happen again when the child is unattractive. In the same vein, Efran (1974) asked participants to play the role of members of a university disciplinary court. Their task was to judge about another student's possible misconduct, such as cheating in an exam. The judges were less likely to believe that the student was guilty and awarded less severe punishment when the defendant was good looking.

Halo effects are not limited to the original target but may transfer to related persons. Sigall and Landy (1973) showed that when participants were shown a beautiful woman, they formed more positive impressions about her male partner. Wilson (1968) found that information about the academic status of a previously unknown guest lecturer influenced the ratings of guest lectures physical height. Even though participants had the opportunity to see and thus actually judge the physical height of the guest lecturer, they still judged him to be taller when the previously given information included high academic status rather than low academic status. Watkins and Johnston (2000) showed that attractive people are more likely to be hired, and when they are, they also are more likely to be paid more (Hammermesh & Biddle, 1993).

Important boundary conditions that limit the generalizability do exist. As mentioned earlier, in Dion and colleagues (1972) classic experiment, the what-is-beautiful-is-good effect did not spread equally to every given dimension but seemed to be moderated by the content of the to be judged dimension. Eagly et al. (1991) confirmed this findings with a meta-analytical approach: The strongest halo effects were found for ratings of social competence, followed by intellectual competence, while ratings of concerns for others and integrity produced the smallest halo effects. Sigall and Ostrove (1975) reported evidence that the what-is-beautiful-is-good effect does not always help the attractive person. In their study, they found that attractive persons were awarded more severe punishment when the attractiveness itself was used to commit a crime, such as swindling. Forgas (2011) reasoned that the induction of negative mood can possibly eliminate halo effects, because negative mood has shown to recruit a more analytical, systematic and externally focused processing strategy.

To summarize, halo effects are a cognitive illusion in impression formation in which perceivers make unwarranted inferences about qualities of a person based on unrelated information that was given about that person. Most importantly, these spread over effects seem to appear always in the same valent direction. Even though the content of the judged dimension matters, it seems that positive information always leads to positive evaluations on related dimensions (halo effect) while negative information always leads to negative evaluations on related dimensions (the devils effect or the horn effect). This, however, has not been tested systematically, yet.

1.6 Evaluative Conditioning

As described earlier, valence is a significant player in two linked domains of psychological research, impression formation and cognitive illusions. But how can subjects acquire valence in the first place? One possible procedure is called Evaluative Conditioning (EC). EC may be best described as an effect that is attributed to a particular core procedure. Specifically, EC refers to a change in the valence of a stimulus (the effect) that is caused by the pairing of that stimulus with another positive or negative stimulus (the procedure) (De Houwer, 2007). The first stimulus is often labeled as the conditioned stimulus (CS), and the second stimulus as unconditioned stimulus (US). A typical outcome would be that the CS becomes more positive when it has been paired with a positive US, and more negative when it has been paired with a negative stimulus. Let's illustrate this with a quick example. Imagine you do like George Clooney. Imagine further how you walk into a kitchen, and you see George Clooney standing right in front of you. But not only is he standing there, he is also holding a cup of coffee in his hands and smiles at you. Unfortunately, George Clooney has to walk out of the scene of our little imagined story now, leaving only you and the cup of coffee in the kitchen. As a result of this encounter, you will be likely to like this cup of coffee a little bit more than you would if you would not have seen George Clooney holding it. To go back to the definition of EC, George Clooney served in this example as the US (positive valence), and he was paired with a CS (cup of coffee). Because both the CS and the US have been presented together, our mind associated the CS with the US, and thus the valence of the US transferred over to the CS. And that is how the little cup of coffee acquired some positive valence.

Modern EC experiments are mostly inspired by Levey and Martin (1975). They introduced the so-called picture-picture paradigm, which is still frequently used by EC researchers. In the standard picture-picture paradigm, neutral pictures serve as CSs and valent pictures serve as USs. In the conditioning phase, the CSs will be presented together with the USs. In the subsequent rating phase, participants are asked to rate the CSs in terms of likability. The result then is, just as described above, that the CSs that were presented together with positive USs were liked more than the CSs that were presented together with negative USs.

EC effects are very robust and well documented (Hofmann, De Houwer, Perugini, Baeyens, & Crombez, 2010). They have been observed in many areas of psychological research, for example in learning psychology (e.g., Martin & Levey, 1978), social psychology (e.g., Olson & Fazio, 2001; Walther 2002), consumer science (e.g., Allen & Janiszewski, 1989), emotion research (e.g., Mallan & Lipp, 2007), neuroscience (e.g., Coppens et al., 2006), nutrition science (e.g., Bernstein & Webster, 1980), clinical psychology (e.g., Hermans et al., 2004) and even in relationship science (McNulty, Olson, Jones, & Acosta, 2017).

Even though EC has been present in variety of domains, the main focus of EC researchers has been on the questions of whether EC is a unique form of Pavlovian conditioning and what are the processes that underlie EC. While research on EC is steadily progressing, the answer to both questions is still under huge debate (e.g., Hofmann et al., 2010), and beyond the scope of the current investigation.

1.7 The valence illusion hypothesis

In the last paragraphs, I outlined the role of valence in impression formation, and in cognitive illusions. I also outlined how valence can be acquired in the first place. In this paragraph, I want to describe how these pieces may fit together and result in, what I call *The Valence Illusion.*

Valence has been the subject of many studies in impression formation, but in these, it has never been manipulated directly. In the studies of halo effects for example, it has been shown that the knowledge about a known characteristic influences the judgment of unknown characteristic of the same person, and it does so in the same valent direction. If you think that George Clooney is beautiful, the what-is-beautiful-is-good effect would predict that you are also likely to think that George Clooney is intelligent. But what happens if you do not know any concrete characteristic of a person (not even his or her physical appearance), but would only know the associated valence? While it is hard to think of a real-life example in which this exact setting applies, the isolation of valence without any confounds might very well offer some important insights in everyday human behavior. How much are our actions and feelings influenced just by pure valence? It is easy to think that we like a person because he or she is very warm and honest. In this case, the characteristics of a person influences our liking. But what if we think that a person is warm and honest, just because we associate positive valence with him or her? This would be what I call the valence illusion.

Let's start with some working definitions that are necessary. In the present investigation, valence will be understood as a latent construct that describes either positivity or negativity. While this definition may be arguable, it can be derived from past research. EC, as one example, is defined as a change in valence of a former neutral stimulus due to the pairing with a valent stimulus. But because valence is a latent construct and thus difficult to measure directly, the standard measure of such a valence change in EC research is likability, the one characteristic that might come closest to valence. If something is positive, it seems reasonable to assume that we will like it. So, while valence will be defined as a latent construct that cannot be measured directly, likability will be understood as the characteristic that is conceptually closest. It does serve as a proxy but is not 100% identical with valence itself.

Grounding on these assumptions, the valence illusion hypothesis states that valence may act as a superordinate dimension in impression formation. As a superordinate dimension, it should influence subordinate dimensions. Because I described valence as either "positivity" or "negativity" (a mix of positivity and negativity would be ambivalence, while the absence of valence would be neutral), I predict that subordinate dimensions to valence would be dimensions that can be described as either positive or negative. To add some examples, most people would certainly agree that honesty is good and lying is bad. So, the valence illusion hypothesis is crystal clear in its prediction: If valence does in fact act as a superordinate dimension, it should affect the judgment of human beings in a systematic fashion. In this case, individuals loaded with positive valence should be judged as more honest then individuals loaded with negative valence.

Finally, I call it a valence *illusion,* because the influence of valence manifests itself as a cognitive bias, and not as a correct observation of the to be judged characteristic. When we believe that person a is more intelligent than person b, only because person a was loaded with positive valence and person b with negative, then this believe is clearly illusional.

1.8 The current investigation

The topic of the current investigation is to explore possible valence effects on impression formation. To do so, it was hypothesized that valence acts as superordinate dimension, and this superordinate dimension affects subordinate dimensions which leads to a cognitive bias.

In order to test these assumptions carefully, two distinct experimental sets were administered. The first set was devoted to the question on how valence can be isolated and manipulated directly, in a way, that is suitable for the investigation of possible valence effects in impression formation.

The second set of experiments was administered to test the far-reaching claim of the valence illusion hypothesis, namely, that valence will influence our judgment on all perceived abilities of human beings when the characteristics in question can be described as either positive or negative.

EC is a procedure that has been used to transfer valence from one stimulus to another. Thus, it seemed to be a perfect fit for the demands of the present investigation. While EC has produced manifold valence effects when photographs of human beings have been served as CSs (e.g., Hütter et al., 2014), it is still an open question whether these valence transfers only affect the very specific stimulus in the experimental setting (e.g., only the very specific photograph of a person, and not the person itself), or whether they spread over to other instances of CSs (e.g., the whole person that was being photographed). For EC to be a plausible explanation for valence effects in real world phenomena, it has to be the case that the valence effects do occur on CSs, even when they are altered in some way. For example, human beings change their appearance regularly, they wear different clothes on different days, change the way their hairs are cut or decide to wear glasses from one day to another. The first set of experiments were designed to test this assumption. A standard EC picture/picture paradigm was set up with pictures of human beings serving as CSs. These photographed human beings were then changed in their appearance, simulating every day changes in real life. I assume that people have to identify the human beings that were paired with valenced stimuli before, because otherwise, people might think that this altered photograph represents a different person. If people do believe that the altered version represents a different person, then I assume that the valence acquired in the conditioning phase does not transfer over to them.

The same standard EC procedures was administered once again, in the second set of experiments. In this, the CSs were not altered anymore after the conditioning phase. However, in the classic way of running an EC procedure, participants will only be asked how much they like the portrayed person. To test the valence illusion hypothesis, nine more characteristics (belonging to the big two) were added in the evaluative rating phase, to check whether the pairings affected characteristics beyond likability.

2. Experiments 1a - 1c

The first set of experiments were concerned with the question the generalizability of EC effects. For EC to be a reasonable procedure for the investigation of valence effects in impression formation, EC effects must transfer over to other instances of the specific CSs used in the conditioning phase. It is not enough that EC procedures cause a change liking of conditioned photographs, by doing so, it must change the liking of the photographed person itself. Experiments 1a - 1c tested whether this is the case by altering the used CSs after the conditioning phase. If not only the specific stimulus acquires valence in EC procedures, but the whole identity of a stimulus, then EC would be a perfect fit for the investigation of the valence illusion hypothesis.

2.1 Prior research.

While this question has not been tackled directly by past research, some experiments came close. One of these experiments was published by Walther (2002). She conducted a set of experiments in which participants were presented photographs of individuals, which served as CSs. In a standard EC procedure, these photographs were then paired with valent stimuli (USs). Before the conditioning procedure, however, participants learned about some associations the portrayed persons have, for example a friend. Importantly, these pre-associates have never been paired with any valent material. As a result, she found the standard EC effect, in which the paired persons acquired the valence of the US. More interestingly, the pre-associates also acquainted the same valence. Walther (2002) demonstrated that the EC effect may not be limited to the specific stimulus that has been paired, but can affect associated stimuli, as well. Hütter, Kutzner, and Fiedler (2014) showed it is possible to not only condition the identity of a stimulus, but to condition specific cues, as well. They paired CSs that shared a unique cue (whereas a cue represents a category such as gender or age; in this example male gender) with mostly positive USs. A small portion of male CSs were paired negatively. They found that positively paired CSs were evaluated more positively, but even CSs that were paired negatively were evaluated positively, if they shared the same positive cue (in this case male gender). Again, the EC effect did not only show on the specific CS that had been paired positively or negatively, but on CSs that were associated with now valent CSs (in this case cues).

In a very recent set of studies, McNulty et al. (2017) asked married couples to view a stream of images of their partners, which then were paired with either positive or neutral images. Participants that were shown their partners pictures coupled with positive images showed more positive automatic partner attitudes than participants that were shown their partners with only neutral stimuli. In a sense, these results show that EC effects can transfer over to judgments about the real person.

Maybe the most direct approach to the question whether the EC procedure affects only a specific photograph of a person, or other instances of that person was done by Unkelbach, Stahl, and Förderer (2012). They used computer-generated male faces as CSs in a standard EC procedure. After the conditioning phase, participants were then presented these computer-generated faces in four conditions (unchanged, with added beard, with added glasses, and with added beard and glasses). Surprisingly, they failed to observe an EC effect in the changed conditions. When they artificially added a beard and/or glasses, the effect evaporated. These (non-)findings are contrary to what the existing literature suggest, and thus need to be examined further. One possible explanation for the non-findings would be that participants did not believe that the altered animated photographs represented the already presented animated individuals, but represented, instead, new identities.

2.2 Experiment 1a

Experiment 1a[1] aimed to demonstrate that the procedure of EC does not only affect the specific CSs, but other instances of that CSs, as well. We hypothesized that because in real world settings, most stimuli will change slightly in appearance, but will still be recognized as the same stimuli that has been seen before. This is especially true for human beings. When meeting person a at time x, he or she might wear different clothes, glasses or may even have a different haircut then when meeting the same person, a at time y. Still, most people will able to identify person a, regardless of the change in appearance. Hence, people should be able to identify the correct person in an EC paradigm, even when the stimuli serving as CSs are changed slightly in appearance. For Experiment 1a, we used photographs of human beings as CSs. These

[1] Daniel Nils Tönsing wrote his bachelor's thesis about Experiment 1a in 2015.

photographs were taken as a full-frontal shot. After the conditioning phase, the conditioned photographs were presented, but this time the angle of the photograph changed (VAC, viewing angle change). Hence, the specific stimuli were changed slightly in appearance, but the identity of the photographed persons remained the same. We expected an EC effect to occur, even on the altered CSs.

2.2.1 Method.

Participants and Design. 64 students (30 female, 33 male, 1 unspecified) from the University of Tübingen, Germany, with a mean age of 22.94 years (SD = 3.01, range 19 – 30 years) participated in this study. They were either compensated with monetary payments (2.50 Euro) or course credit. The design was a 2 (valence: positive vs. negative) × 3 (change of perspective: 0° vs. 45° vs. 90°) within-subjects design with repeated measures. Additionally, correct recognition of used CSs was measured.

Materials and Procedure. The first experiment is described in greater detail than the subsequent ones, which follow the same general procedure. Participants were greeted by either a male or a female experimenter and seated in front of a computer screen. Every participant was seated in a separate room. The experiment consisted of three phases, which were administered entirely by a computer program: the conditioning phase, the evaluative rating phase, and the recognition phase. The instructions informed participants that it was their task to observe a stream of pictures on the computer screen. The size of the monitor was 19 inches and the resolution was 1920 x 1080 pixels. In the conditioning phase, 12 portrait photographs (6 female, 6 male) from the Radboud Faces Database (RaFD; Langer, Dotsch, Bijlstra, Wigboldus, Hawk, & Knippenberg, 2010) served as CSs and had a size of 384 x 577 pixels. In a pretest, the six male portrait photos and the six female portrait photos did not differ in likeability, $t(57) = 0.19$, $p = .857$. 96 (48 positive, 48 negative) pictures from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 1999) served as USs. The size of the USs was 472 x 472 pixels. The USs did differ in terms of valence, $t(96) = 11.82$, $p < .001$, meaning that positive pictures were indeed rated as more positive than negative pictures. CSs were randomly assigned to US valence for each participant. CSs and USs were placed in the center of the screen, while the position of the CSs and USs (left vs. right) rotated. Each CS was paired 8 times with positive (negative) USs for a total of 96 CS-US pairings. Every CS-US pair was presented for 3 seconds, the interstimulus interval (ISI) was set to 500 ms. In the conditioning phase, all portrait photographs were a full-frontal shot. In the evaluative rating phase, participants were presented the same portrayed persons (CSs) used in the conditioning phase and asked to rate them on how much they would like the portrayed person, on a scale ranging from -50 (not at all) to 50 (very much)[2]. To do so, participants were presented a continuous slider, where the negative value was always on the left side and the positive value always on the right side. In this rating phase, however, the same portrayed persons were not only presented in a full-frontal photograph, but in a photograph showing them from a 45° and a 90° viewing angle, respectively. The direction in which the person seems to look (left or right) was set to 50% each. In the recognition phase, 12 (6 female, 6 male) more portrait photos were taken from the same database (RaFD) to serve as distractors and were added randomly in the mix. Viewing angles of the distractors were balanced, as well. For the recognition test, participants were simply asked whether they have seen the portrayed person before in this experiment or not (Answers: yes vs. no). This was done to check whether the possible EC effect occurred only for those portrayed persons that were in fact conditioned with valence.

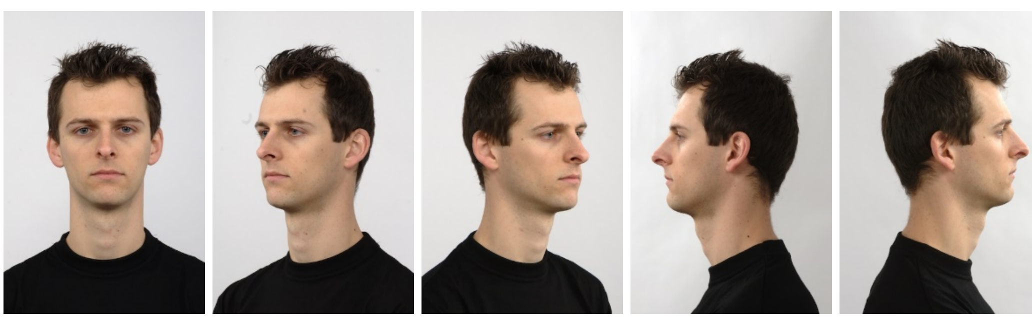

Figure 1. Example CS in different viewing angles. 1. Full-frontal, 2. 45° VAC with left orientation, 3. 45° VAC with right orientation, 4. 90° VAC with left orientation, and 5. 90° VAC with right orientation.

Data preparation and analysis. For all reported experiments, multilevel model analyses were calculated for all dependent measures to assess relationships on a trial-by-trial basis (Judd, Westfall, & Kenny, 2012)[3]. All models contained random intercepts for participants and items,

[2] Exact wordings of all tested items throughout this dissertation are given in Appendix B
[3] The code is given in Appendix C

which were fully crossed by design. The effects of our hypothesized predictors were always fixed, and the full hypothesized models will always be reported. For all multilevel model analyses, effect coding was used (for a discussion of effect coding vs. dummy coding, see Kugler, Trail, Dziak, & Collins, 2012). US valence was always coded as -1 for negative valance and 1 for positive valence. The potential moderation of US valence effects by viewing angle change was tested by contrasts, meaning that the levels of viewing angle change (VAC) were tested against the baseline condition (no change in the viewing angles of CSs after the conditioning phase). The evaluative ratings were always based on a post-post analysis (difference of positively and negatively paired CSs after the conditioning phase) which can be considered as the superior control group in comparison to a pre-post analysis (difference of pre-ratings before and post-ratings after the conditioning phase) in that it also controls for mere exposure (Hofmann, De Houwer, Perugini, Baeyens, & Crombez, 2010). The recognition ratings were always standardized. For a better readability, only p-values of non-significant results were reported in the results section. Full statistics are given in Appendix A.

2.2.2 Results

Recognition rates (RR). Overall, participants recalled 94.35% of used CSs correctly. In the unchanged condition, 96.12% of used CSs were recalled correctly, in the 45° change condition 95.30% of used CSs were recalled correctly and in the 90° change condition 91.18% of used CSs were recalled correctly. Participants identified the correct persons, even when the viewing angle was changed.

Evaluative ratings. US valence was a significant predictor of CS likeability, $b = 4.73$, $se = 1.11$, $t = 4.27$, $p < .001$, indicating that CSs paired with positive USs were rated more positively than CSs paired with negative USs. There was no effect for VAC of 45° ($p = .82$). There was a marginal effect for VAC of 90°, $b = 2.96$, $se = 1.57$, $p = .06$, indicating that CSs were evaluated more positively when the viewing angle of the portrayed person was changed by 90°. RR did not predict CS likeability ($p = .48$). The effect for US valence was not moderated by VAC, neither by 45° change ($p = .63$), nor by 90° change ($p = .16$), indicating that the effect of US valence did not differ depending on the levels of VAC. RR did not interact with any predictor (all *p*s > .18).

2.2.3 Discussion.

Participants rated portrait photographs more positively when they were paired with positive USs than CSs that were paired with negative USs, demonstrating the standard EC effect. Interestingly, this effect was independent from VAC.

As predicted, the EC effect did occur, even when the CSs were altered. However, it was hypothesized that this effect should have only occurred for those CSs that were correctly remembered. There are two possible reasons for this (non-)finding. First, participants were able to correctly identify more than 94% of presented photographs. This means that it is possible that there has been too little variance in this measure. Second, in the literature, there is evidence for EC effects even when participants do not recall the used stimuli correctly (e.g., Hütter, Sweldens, Stahl, Unkelbach, & Klauer, 2012).

2.3 Experiment 1b

Experiment 1b was designed to replicate the main finding of Experiment 1a. We expected the EC effect to occur once again, regardless of any VAC. Because of the very high correct RR, I doubled the amount of CSs and distractors to make the recognition task a little bit more difficult. To fully maximize the randomization procedure for presenting stimuli, this time the photographs in the conditioning phase were taken in different viewing angles, as well.

2.3.1 Method.

Participants and design. 64 Students (44 female, 20 male) students of the University of Tübingen, Germany, participated in this study. The mean age was 27.22 years (*SD* = 11.12, ranging from 18 to 63 years). They were either compensated with monetary payments (2.50 Euro) or course credit. The design was a 2 (valence: positive vs. negative) × 3 (change of perspective: 0° vs. 45° vs. 90°) within-subjects design. Additionally, recognition of used CSs was measured.

Materials and procedure. Materials and procedure were the same as used in Experiment 1a, with the following exceptions: The amount of CSs was doubled to 24 portrait photos (12 female, 12 male). Complementary, the number of distractors were doubled to the same amount (24; 12 female, 12 male). Both, the CSs and the distractors were taken from of the RaFD database. While in experiment 1 CSs in the conditioning phase were always presented from a frontal view, in experiment 2 they were randomly presented from either a frontal perspective or from a 90° viewing angle. In the rating phase, the change in the viewing angle was measured (change of 0°, change of 45° and change of 90°). While in Experiment 1 the recognition task was always presented after the evaluative ratings, this time 50% of participants were asked to perform the test before the evaluative ratings.

2.3.2 Results.

Recognition rates. Overall, participants recalled 72.98% of used CSs correctly. In the unchanged condition, 80.86% of used CSs were recalled correctly, in the 45° Change condition 64.84% of used CSs were recalled correctly and in the 90° Change condition 73.24% of used CSs were recalled correctly. Again, participants identified the correct persons, even when the viewing angle was changed, but did so to a lesser degree than in experiment 1a.

Evaluative ratings. US valence was a marginal significant predictor of CS likeability, $b = 1.46$, $se = .76$, $t = 1.91$, $p = .056$, indicating that CSs paired with positive USs were rated more positively than CSs paired with negative USs. There was a marginal significant effect for VAC of 45°, $b = 1.80$, $se = 1.08$, $t = 1.66$, $p = .098$, indicating that CSs that were presented in a 45°-degree change were evaluated more positively, regardless of US valence. There was no significant effect for VAC of 90° ($p = .66$). RR was a significant predictor for CS likeability, $b = 2.44$, $se = .87$, $t = 2.80$, $p < .01$, indicating that CSs that were correctly recognized were evaluated more positively than CSs that were not recognized. The effect for US valence was not moderated by VAC, neither by 45° change ($p = .74$), nor by 90° change ($p = .66$), indicating that the effect of US valence did not differ depending on the levels of VAC. RR did not interact with any predictor (all *p*s > .10).

2.3.3 Discussion.

Experiment 1b was designed as a replication of experiment 1a with a more sophisticated design. The results of experiment 1b confirmed the general findings of experiment 1a, with some differences. First, as intended, participants recognized the correct CSs to a lesser degree. Second, the standard EC effect did show, but was only marginally significant. As in experiment 1a, the relationship of US valence and CS ratings was independent of any VAC. Again, the correct recognition of a formerly presented CS did not moderate any effect. Because the recognition test

was more difficult this time, there was more variance in this measure, but the hypothesized effect was not found. These results may again support the notion of contingency unaware EC.
Lastly, participants rated correct recognized CSs as more favorable then unrecognized CSs. One potential explanation for this unexpected finding could be the mere exposure effect (Zajonc, 1968), in which repeated exposure to a stimulus could potentially result in a greater liking for that stimulus.

2.4 Experiment 1c

The third experiment aimed to simulate a more realistic scenario for everyday change in the appearance of human individuals. The whole set of experiments 1a - 1c was designed to answer the question whether EC procedures are a plausible explanation for the acquaintance of valence effects in person perception in the real word. The most likely way a person's appearance changes from time x to time y may lie in fashion choices. For this reason, the change in appearance was manipulated by adding (or subtracting) glasses to the photographed persons. This manipulation has two main advantages. First, it simulated everyday change in appearance in the real world, and second, it allows for a direct comparison with Unkelbach and colleagues (2012) non-finding. While Unkelbach et al. (2012) used artificial faces in their experiments, this experiment is done with real photographs of persons, and the glasses were added by a professional designer.

2.4.1 Method.

Participants and design. 80 students (62 female, 18 male) of the University of Tübingen, Germany, participated in this study. The mean age was 22.03 years (*SD* = 6.32, ranging from 18 to 65 years). They were either compensated with monetary payments (2.50 Euro) or course credit. The design was a 2 (valence: positive vs. negative) × 2 (change of CS feature: glasses vs. no change of CS feature: glasses) within-subjects design.

Materials and procedure. In Experiment 1c, the same basic EC procedure was used. This time, however, the change of the CS features was manipulated by presenting portrait photos of the same person either with or without glasses. Two versions (with and without glasses) of 16 different portrait photographs (8 female, 8 male) served as CSs (resulting in a total of 32 CSs).

Additionally, two versions (with and without glasses) of 16 different portrait photographs (8 female, 8 male) served as distractors in the recognition test. Both versions (with or without glasses) appeared in the conditioning phase as well as in the evaluative rating phase. The likeability scale for the evaluative rating ranged from 0 (not at all) to 100 (very much), the recognition test was the same as in Experiment 1a and 1b.

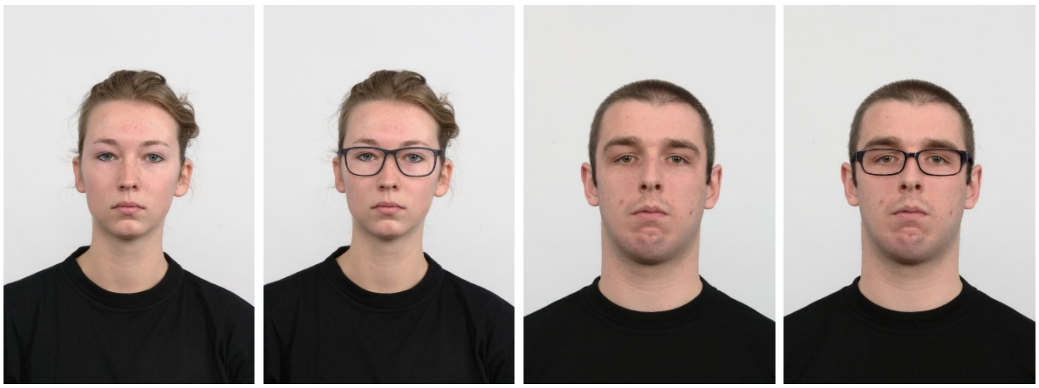

Figure 2. Example CSs with and without glasses.

2.4.2 Results.

Recognition rates. Overall, participants recalled 81.48% of used CSs correctly. In the unchanged condition, 87.34% of used CSs were recalled correctly, in the change condition 75.63% of used CSs were recalled correctly. Participants were able to identify the correct person to a large degree, even when glasses were added (or subtracted).

Evaluative ratings. Across conditions, US valence was a significant predictor of CS likeability, $b = 3.15$, $se = 0.97$, $t = 3.25$, $p < .01$, indicating that CSs paired with positive USs were rated more positively than CSs paired with negative USs. The change of the CS feature was no significant predictor of CS likeability ($p = .91$), and more importantly, change of CS feature did not moderate the effect of US valence ($p = .71$). The recognition ratings were no significant predictor for CS likeability ($p = .30$). There was a marginal significant interaction of US valence and correct recognition of the CSs, $b = 1.75$, $se = 1.03$, $t = 1.70$, $p = .09$, indicating that the found EC effect might only be true for those CSs participants recalled correctly (regardless or the CS feature change). There was no other significant interaction (all ps > .41).

2.4.3 Discussion.

Experiment 1c confirmed that EC effects do occur for altered stimuli. This time, EC effects were found for persons, regardless of them adding or subtracting glasses after the conditioning phase. This time, however, the hypothesized influence of correct recognized individuals did moderate the EC effect, even though only marginally significant.

These results make it likely that EC procedures can account for valence effects in real world person perception, the main question that was investigated in this first experimental series. Experiment 1c suggests that the correct identification of the conditioned stimuli may play a significant role, after all. This result, however, stays in contrast to the findings of Experiment 1a and 1b.

These results do also stay in contrast with the (non-)findings of Unkelbach et al. (2012), who did not find a spread over EC effect on altered CSs by employing a very similar experiment. The main difference between experiment 1c and the one Unkelbach and colleagues (2012) administered lies in the choice of stimuli. While Unkelbach et al. (2012) used completely artificial faces, we used real photographs. The use of artificial portraits may have confused participants. It is thinkable that they did not encode the changed faces as belonging to the same artificial person presented earlier, but instead, may represent a new identity.

2.5 General discussion Experiments 1a - 1c

Experiments 1a - 1c suggests that EC is a reasonable procedure to produce valence effects in impression formation. Participants were presented photographs of individuals, and these photographs were paired with either positive or negative valence. Afterwards, participants liked positively paired photographs more than negatively paired photographs. Most importantly, the change in liking did not only occur for the specific photographs used in the conditioning phase, but generalized to photographs showing the same, but altered individual. In Experiment 1a and 1b, these alterations were administered by changing the angle in which the individual was photographed, in experiment 1c the individuals were altered by added (subtracted) glasses to simulate alterations that are common in real life encounters with human beings.

These findings are important for the explanatory power of EC. Valence effects produced by EC procedures in the lab would be of very little explanatory power if only the very specific stimulus that was used would profit from the pairings. The results show, however, that this is not the case. Valence effects produced by EC procedures do generalize over to altered versions of the presented stimulus. It was hypothesized that this generalization should only occur for altered stimuli participants correctly identify as belonging to the same identity of the previously seen stimuli. To investigate whether this is the case, participants were asked to identify previously seen individuals as being part of earlier phases of the experiment. The results have been mixed and do not allow for a conclusive interpretation. While in Experiments 1a and 1b the correct identification did not moderate the valence effect, in Experiment 1c it did (but only marginally). A possible explanation for found generalizations of valence effects even on those altered stimuli that were not correctly identified is contingency unaware EC, but future research needs to address this question in greater detail.

3. Experiments 2a - 2d

After demonstrating that EC procedures are a reasonable tool to investigate valence effects on impression formation, the second set of experiments was devoted to the question which dimensions are affected by valence manipulations, and most importantly, why.

As noted earlier, the hypothesized valence illusion predicts that valence should influence all dimensions that can be described as either positive or negative. In the history of research on impression formation, characteristics that belong to the big two, agency and communion, have emerged as the center dimensions when describing other persons. It has also been shown that valence seems to play a role in these judgments, for example in halo effects.

We predict that valence acts as a superordinate dimension that influences subordinate dimensions, which are all dimensions that can be described as either positive or negative. Thus, the first three experiments of the second set of experiments are devoted to the question whether valence does in fact influence other dimensions in the hypothesized way. To test this, ten characteristics that belong to either agentic or communal traits served as dependent variables, because all of them can be described as either positive or negative. In the last experiment, the exact relationship of valence and the tested characteristics was the main source of interest.

3.1 Experiment 2a

The first experiment of the second set aimed to gather first evidence that valence affects other characteristics beyond likability. Likability is the classic dependent variable used in EC paradigms to measure the change in valence. Halo effects suggest that in impression formation, one known characteristic can influence the judgment about other, unknown characteristics of one person, and it seems do so in the same valence. But what happens if no concrete characteristic is known, but only the valence associated with a person?

In past research, agency and communion have emerged as the big two dimensions of impression formation, so they seemed to be a reasonable choice do serve as dependent variables. Past research suggests that halo effects occur for unknown, but related characteristics. For example, when it is known that person a is intelligent, people would also believe that he or she might be very productive, because both characteristics, intelligence and being productive, belong to agentic traits.

We hypothesized that valence might act as a superordinate dimension in impression formation, and that it should influence all dimensions that can be described as either positive or negative. If that is true, we expected valence to affect both, agentic and communal related characteristics, because of all them can be described as positive or negative. To test this hypothesis, Experiment 2a administered a standard EC picture/picture paradigm. As in these standard paradigms, likability served as a dependent variable. Additionally, nine more characteristics that belong to either agency or communion were tested.

3.1.1 Method.

Participants and design. 36 students of the University of Tübingen, Germany, participated in this study.[4] They were either compensated with monetary payments (2.50 Euro) or course credit. The design was a 2 (valence: positive vs. negative) × 10 (characteristics) within-subjects design.

Materials and procedure. The general procedure was the same as in Experiment 1a, but without altering the CSs afterwards. This time, 16 naturalistic portrait photographs (8 female, 8 male) served as CSs and were taken from Hütter, Sweldens, Stahl, Unkelbach and Klauer (2012). USs were the same as in Experiments 1a and 1b. It is noteworthy that selected USs did not contain any pictures of human beings to avoid any possible interferences. After the conditioning phase, participants were asked to rate the portrayed persons on ten different characteristics, always on a scale ranging from -50 to 50 (e.g., "How intelligent is this person?"). Five of these characteristics were agency related (competency, efficiency, full of energy, intelligence, respectability) and five communion related (fairness, honesty, likability, loyalty, sincerity). Because likability does not only belong to communion related characteristics, but is also the standard measure of EC effects, it also serves as a manipulation check.

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[4] Due to an error in the computer program, age and sex of participants were not saved. Because the recruitment process was identical to the other reported experiments, a similar representation is likely.

3.1.2 Results.

As can be seen in Table 1, US valence was a significant predictor for all ten tested characteristics, meaning that CSs paired with positive USs were rated more positively than CSs paired with negative USs, regardless of the specific attribute.

Table 1

Results of Experiment 2a

Attribute	*b*	*se*	*t*	*p*
Agency				
Competency	4.95	0.82	6.06	< .001
Efficiency	2.05	0.76	2.72	< .01
Full of energy	4.48	0.86	5.22	< .001
Intelligence	2.39	0.71	3.37	< .001
Respectability	3.74	0.83	4.50	<. 001
Communion				
Fairness	6.74	0.81	8.30	< .001
Honesty	7.16	0.87	8.27	< .001
Likability	6.76	0.90	7.48	< .001
Loyalty	6.87	0.87	7.89	< .001
Sincerity	6.56	0.82	7.99	< .001

Note: Relationships of US valence and type of characteristics on a trial by trial basis.

Agency and communion. To investigate whether the effect of US valence was moderated by the type of characteristics (agency or communion), an additional multilevel model analysis was conducted, and effect coding was used. Agency related characteristics were coded as -1, while Communion related characteristics were coded as 1. US valence was a significant predictor for CS overall ratings, $b = 3.54$, $se = 0.69$, $t = 5.12$, $p < .001$, indicating that CSs paired with positive USs were rated more positively across all evaluative ratings than CSs paired with negative USs. Type of characteristics was a significant predictor for CS overall ratings, $b = -3.40$, $se = 0.98$, $t = -3.49$, $p < .001$, indicating that CSs received higher scores on agency related characteristics than on communion related characteristics. These main effects were, however, qualified by an interaction of US valence and type of characteristics, $b = 3.25$, $se = 0.98$, $t = 3.33$, $p < .001$, indicating that the effect of US valence was stronger for communion related characteristics than for agency related characteristics.

3.1.3 Discussion.

The valence illusion hypothesis predicted that valence acts as a superordinate dimension in impression formation, and thus should influence all dimensions that can be described as either positive or negative. The results of experiment 2a strongly supported this hypothesis. All ten tested characteristics were influenced by valence, and the influence was always in line with US valence, meaning that a positively paired person was rated as more positive on every tested characteristic in contrast to negatively paired persons.

Interestingly, the relationship of valence and characteristic was moderated by the type of characteristic. Characteristics belonging to the dimension of communion were affected more strongly by valence than characteristics belonging to the dimension of agency. Even though not directly predicted, it may still support the reasoning of the valence illusion hypothesis. That is because likability is used as the standard measure of valence effects in EC procedures (e.g., Hofman et al., 2010), it can be argued that likability may be the closest characteristic to the latent variable valence. If that is the case, the results suggest that the perceived distance from one characteristic to the latent variable valence might predict the size of the valence effect on that characteristic. From an evolutionary perspective, communal characteristics might be more diagnostic than agentic characteristics. That is because it may be more important for surviving to identify the intentions of unknown people first, and judging their abilities to carry out these intentions second (Abele & Bruckmüller, 2011)

On a procedural level, the selection of USs was taken with care. For example, all pictures containing any human being were sorted out beforehand to rule out any possible interference with perceived characteristics of shown human beings. However, the USs did contain living creatures and nature. One possible alternative explanation might be that the USs possibly contained, for some reasons, pictures that, for the participants, did relate more to communal characteristics like warmth, than agentic characteristics like being productive. Experiment 2a cannot rule out such a critique.

3.2 Experiment 2b

Experiment 2b served two main purposes. First, it aimed to replicate the findings of experiment 2a. Once again, valence should influence all given characteristics. Second, experiment 2b was designed to eliminate the possible alternative explanation in that not valence directly might have caused the effects, but the pictures served as USs did maybe contain more information than just pure valence. For this reason, the pictures serving as USs were replaced by the written words “positive” and “negative”. This way, any significant difference can be attributed directly to pure valence.

3.2.1 Method.

Participants and design. 35 students (27 female, 8 male) of the University of Tübingen, Germany, participated in this study. The mean age was 22.94 years (*SD* = 3.67, ranging from 19 to 34 years. They were either compensated with monetary payments (2.50 Euro) or course credit. The design was a 2 (valence: positive vs. negative) × 10 (Characteristics) within-subjects design.

Materials and Procedure. Experiment 2b is complete replication of Experiment 2a, with one significant exception: The pictures served as USs in experiment 2a contained animals and/or pictures of natural environments. In this experiment, the written words positive (positive valence) and negative (negative valence) replaced the pictures as serving USs. Everything else was held constant to Experiment 2a.

3.2.2 Results.

As shown in Table 2, Experiment 2b replicated the main findings of Experiment 2a. Four Agency related attributes and four Communion related attributes were influenced by US valence. The tests for full of energy (Agency) and loyalty (Communion) failed to reach significance.

Table 2

Results of Experiment 2b

Attribute	*b*	*se*	*t*	*p*
Agency				
Competency	2.28	0.70	3.27	< .01
Efficiency	1.84	0.67	2.74	< .01
Full of energy	1.41	0.80	1.75	.08
Intelligence	1.87	0.65	2.87	< .01
Respectability	2.21	0.70	3.15	<. 01
Communion				
Fairness	3.24	0.75	4.33	< .001
Honesty	2.63	0.77	3.41	< .001
Likability	1.77	0.83	2.12	< .05
Loyalty	1.05	0.78	1.35	.18
Sincerity	1.75	0.76	2.29	< .05

Note: Relationships of US valence and type of characteristics on a trial by trial basis.

Agency and communion. US valence was a significant predictor for CS overall ratings, $b = 1.99$, $se = 0.61$, $t = 3.28$, $p < .01$, indicating that CSs paired with positive USs were rated more positively across all evaluative ratings than CSs paired with negative USs. Type of characteristics was a significant predictor for CS overall ratings, $b = -3.03$, $se = 0.86$, $t = -3.53$, $p < .001$, indicating that CSs received higher scores on Agency related characteristics than on Communion related characteristics. There was no significant interaction of US valence and type of characteristics ($p = .98$), indicating that there was no difference in the effect of US valence on Agency- or Communion-related characteristics.

3.2.3 Discussion.

Experiment 2b replicated the main finding of experiment 2a: Valence did influence all ten tested characteristics, as predicted by the valence illusion hypothesis. This time, however, communal characteristics were not affected stronger by valence than agentic characteristics. The results add further support to the idea that valence acts as a superordinate dimension in impression formation by replicating these findings in another independent experiment. The results did not support any idea of communal characteristics being influenced more by valence than agentic characteristics that were brought up in the aftermath of experiment 2a. Because of the conflicting results on this issue, it remains an open question whether valence does influence different characteristics with different effect sizes.

3.3 Experiment 2c

Experiment 2c aimed to shed light on the nature of the conflicting findings of experiments 2a and 2b. In both experiments, valence did influence all characteristics, regardless of them belonging to the agentic or communal dimension. In experiment 2a, communal characteristics were affected more strongly than their agentic counterparts. In experiment 2b, this distinction was absent. These conflicting results were observed in two nearly identical experimental settings, with the only difference being pictures or words serving as USs. The nature of this relationship is nonetheless of theoretical importance. If communal characteristics do get affected more strongly by valence than agentic characteristics, this would give us some insights to possible underlying processes, as mentioned in the aftermath of experiment 2a. Thus, experiment 2c was set up to replicate both, experiment 2a and 2b, in one experiment, treating the different USs as an experimental factor. First of all, this allows to test whether the difference between the two experiments holds true in a replication, and secondly, it allows for a direct test of the size of the valence effect caused by the different types of USs.

3.3.1 Method.

Participants and design. 77 students (58 female, 19 male) of the University of Tübingen, Germany, participated in this study. The mean age was 23.45 years (SD = 4.44, ranging from 18 to 52 years). They were either compensated with monetary payments (2.50 Euro) or course credit. The design was a 2 (valence: positive vs. negative) × 2 (Type of characteristics: Agency vs. Communion) X 2 (US material: pictures vs. words) mixed design with repeated measures on the first two factors. The factor US material was manipulated between subjects.

Materials and procedure. Experiment 2c is a combined replication of experiments 2a and 2b, treating the difference of both experiments (US stimuli) as an experimental factor. Everything was identical to both previous experiments. The assignment to the two experimental groups was completely random.

3.3.2 Results.

Because experiment 2c was designed to test the effect of US material on the interaction of type of characteristics, only the grand analysis will be reported.[5] Agency and Communion. US valence was a significant predictor for CS overall ratings, $b = 3.18$, $se = 0.33$, $t = 9.67$, $p < .001$, indicating that CSs paired with positive USs were rated more positively on both, agency- and communion-related characteristics than CSs paired with negative USs. Type of characteristics was a significant predictor for CS overall ratings, $b = -1.43$, $se = 0.33$, $t = -4.35$, $p < .001$, indicating that CSs received higher scores on agency related characteristics than on communion related characteristics. There was a significant interaction of US valence and type of characteristics, $b = 1.16$, $se = 0.33$, $t = 3.54$, $p < .001$, indicating that the effect of US valence was stronger for communion related characteristics than for agency related characteristics. There was a marginal significant interaction of US valence and type of US material, $b = -0.60$, $se = 0.33$, $t = -1.82$, $p = .07$, indicating that the effect of US valence was stronger in the picture/picture paradigm than in the picture/word paradigm. However, the interaction of US valence and type of characteristics did not depend on US material ($p = .17$).

3.3.3 Discussion.

The results of experiment 2c confirmed, once again, the valence illusion hypothesis. Valence did influence all tested items that can be described as either positive or negative. Most interestingly, the relationship of valence and tested characteristic was moderated by the type of characteristics: The results mirrored the pattern of Experiment 2a in which communal characteristics were influenced even more by valence than agentic characteristics. Additionally, valent pictures had a stronger influence than valent words overall, meaning that the valence manipulation was more potent with pictures rather than words.

These results suggest that it is reasonable to hypothesize that valence does have a significantly different impact on different characteristics. At the same time, the results further highlight the important question on *why* this is the case.

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[5] A multilevel model analysis on each individual perceived characteristic revealed the same pattern of results as reported in experiments 2a and 2b. Full results are given in Appendix A.

3.4 Experiment 2d

Experiment 2d was administered to investigate the question *why* certain characteristics are more influenced by valence manipulations than others. It confirmed that characteristics related to the communal dimension were more heavily affected by valence than their agentic counterparts.

One reason might be that likability, the standard measure of valence effects in EC, may be the one characteristic that is conceptually closest to the latent variable of interest, valence. If that is the case, then the perceived distance from any given characteristic towards likability should predict the size of the valence effect. One way of testing the distance between two cognitive concepts is multidimensional scaling. The Spatial Arrangement Method (SpAM; Hout, Goldinger, & Ferguson, 2013) is a tool to collect similarity data for items in a multi-dimensional space. It is built upon the assumption that people can reliably and validly sort attitude objects in a way that more similar attitude objects are located more closely to another. It has been shown to be as effective as traditional methods to collect similarity data for multidimensional scaling but is more efficient when dealing with more attitude objects at once. The method has been successfully used with agency and communion items before (e. g., Koch, Imhoff, Dotsch, Unkelbach, & Alves, 2016). We expected the spatial distance of any of the nine tested characteristics before towards the characteristic likability to predict the size of the valence effect on that characteristic.

3.4.1 Method.

Participants and design. 79 students (59 female, 20 male) of the University of Tübingen, Germany, participated in this study. The mean age was 22.59 years (*SD* = 4.43, ranging from 18 to 48 years). They were either compensated with monetary payments (4.00 Euro) or course credit. The design was a 2 (valence: positive vs. negative) × 10 (type of characteristics) within-subjects design, with the spatial distances between the different characteristics as an additional measure.

Materials and procedure. The same procedure and materials were used as in experiment 2a. After completing the EC procedure, participants were introduced to SpAM (Hout et al., 2013). In this, participants were shown all ten characteristics (in German language) in a random order on a computer screen and were asked to sort these characteristics by their similarity in a multidimensional space (see Figure 3). The sorting was done by simply clicking the mouse button and moving it to the desired space. The similarity of characteristics is represented by the Euclidean distance of any two characteristics. In this case, all Euclidean distances from any of the nine remaining characteristics towards likability were measured.

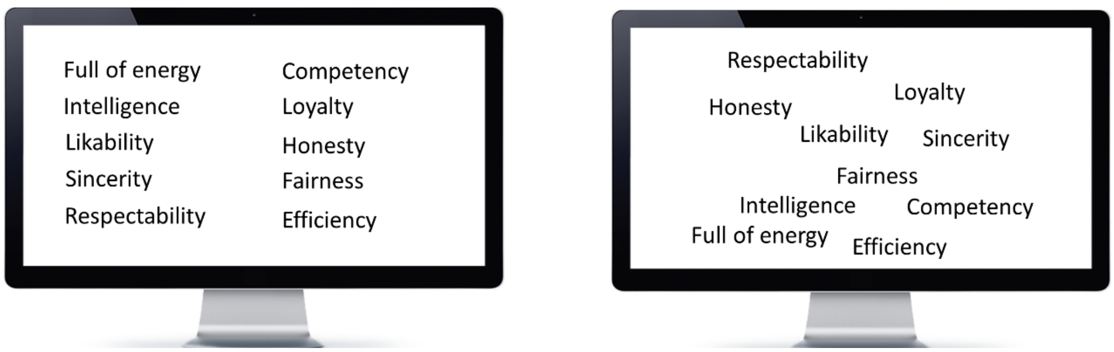

Figure 3. Possible starting and end screens of the SpAM-Method (Hout et al., 2013) in English language. Translation: Full of energy = Voller Energie, Intelligence = Intelligenz, Likability = Sympathie, Sincerity = Aufrichtigkeit, Respectability = Respekt, Competency = Kompetenz, Honesty = Ehrlichkeit , Fainess = Fair, Efficiency = Effizienz.

3.4.2 Results.

Experiment 2d replicated the patterns found previously, as can be seen in Table 3. US valence was a significant predictor for all ten testes attributes.

Table 3

Results of Experiment 2d

	b	*se*	*t*	*p*
Agency				
Competency	3.28	0.53	6.25	< .001
Efficiency	2.61	0.51	5.17	< .001
Full of energy	3.01	0.58	5.23	< .001
Intelligence	2.82	0.49	5.78	< .001
Respectability	2.80	0.53	5.31	<. 001
Communion				
Fairness	5.38	0.58	9.30	< .001
Honesty	5.45	0.57	9.57	< .001
Likability	5.45	0.63	8.86	< .001
Loyalty	5.47	0.58	9.52	< .001
Sincerity	5.18	0.56	9.25	< .001

Note: Relationships of US valence and type of characteristics on a trial by trial basis.

Agency and communion. US valence was a significant predictor for CS overall ratings, $b = 4.15$, $se = 0.33$, $t = 12.75$, $p < .001$, indicating that CSs paired with positive USs were rated more positively across all evaluative ratings than CSs paired with negative USs. Type of characteristics was a significant predictor for CS overall ratings, $b = -1.45$, $se = 0.33$, $t = -4.45$, $p < .001$, indicating that CSs received higher scores on Agency related characteristics than on Communion related characteristics. These main effects were, once again, qualified by an interaction of US valence and type of characteristics, $b = 1.23$, $se = 0.33$, $t = 3.77$, $p < .001$, indicating that the effect of US valence was stronger for communion related characteristics than for agency related characteristics.

Spatial distances. The mean Euclidean distance from all agency-related characteristics combined towards likability was 465 pixels, the mean Euclidean distance from all communion related characteristics (minus likability) combined towards likability was 311 pixels, on a group level (see Table 4). In the reported multilevel model analysis, the relationship of the spatial distance of any tested perceived characteristic and the valence effect on that perceived characteristic was tested on a trial-by-trial basis. Spatial distance to likability was a significant predictor for the US valence effect on any tested characteristic, $b = -0.003$, $se = 0.001$, $t = -2.10$, $p < .05$.

Table 4

Spatial Distances

Agency	Distance	Communion	Distance
Competency	468	Fairness	283
Efficiency	547	Honesty	354
Full of energy	480	Loyalty	315
Intelligence	493	Sincerity	290
Respectability	305		
Mean	465	Mean	310

Note: Distance = Euclidean distance from any given attribute towards likability in pixels. All values represent mean values on a group level.

3.4.3 Discussion.

The last experiment supported the hypothesis that valence acts as superordinate dimension in impression formation. It was hypothesized that likability is the one characteristic that is closest to the latent construct valence, and because of this the spatial distance of any given characteristic towards likability should predict the size of the effect valence has on that characteristic. This was true for all nine characteristics that were tested. These results directly explain why communal characteristics were more influenced by valence than agentic characteristics, a pattern that was replicated in this final experiment, as well, because communal characteristics are conceptually more similar to likability than agentic characteristics.

The results of experiment 2d also sum up the patterns observed in experiments 2a - 2d. First, acts as superordinate dimension in impression formation. Second, this superordinate dimension should influence all subordinate dimensions, which were defined as all dimensions that can be described as either positive or negative. Third, valence influences communal characteristics more strongly than agentic characteristics and fourth, this effect can be explained by the conceptual similarity (measured as spatial distances) of any given characteristic towards likability. These findings allow for precise predictions of valence effects in impression formation that go beyond the tested characteristics in this investigation.

4. General Discussion

The current investigation demonstrated that valence plays a big role in impression formation. EC has been used to isolate and manipulate valence directly. The first set of experiments showed that EC is a reasonable procedure investigate valence effects in impression formation. That is because the acquired valence did not only affect the specific stimulus used in the conditioning phase, but transferred over to altered versions, an essential prerequisite for the explanatory power of EC on real world valence effects. The process behind this transfer remains unclear. It was hypothesized that in EC procedures, not only the specific stimulus acquires valence (e.g., the picture of a person) but the whole cognitive concept (e.g., the pictured person itself). The data showed a mixed pattern on this issue, mirroring the mixed findings on underlying cognitive processes of EC procedures in general (e.g., Hofmann et al., 2010)
The second set of experiments supported the valence illusion hypothesis, which states that valence acts as a superordinate dimension that influences subordinate dimensions. It has been shown that valence affects characteristics beyond likability, the standard measure of EC effects. Valence did influence characteristics that belong to communion more strongly than characteristics that belong to agency. This difference in size of the valence effect can be predicted by the spatial distance of the given characteristic towards likability.

4.1 Putting the valence illusion into context

In the literature of impression formation, other spread over effects have been documented. The most similar effect to the valence illusion is the halo effect, which describes a tendency of judges to assume that once a person possesses some known good (or bad) characteristics, their other, unrelated and unknown characteristics are likely to be consistent with the good (or bad) known characteristic (Forgas & Laham, 2017). Consistent with this definition, past research on halo effects has focused on presenting a given characteristic and the spread over of this characteristic then was labeled a halo effect. Hence, the halo effect needs a given characteristic as a starting point, like beauty in the what-is-beautiful-is-good-effect (Dion et al., 1972). The present research took a more process-oriented route. By manipulating valence directly, there was not a single characteristic of a person that served as a starting point. Valence then caused a cognitive bias similar to the halo effect.

The main difference of the halo effect and the valence illusion lies in the causal chain: halo effects start with a known characteristic and affect other characteristics, the valence illusion starts without a known characteristic, but with a positive (or negative) event. While the source of the spread over effect in halo effects lies at least to some degree in the person (i.e., it is the person itself that is beautiful), the source of the valence associated with the person in the valence illusion effect does not *need* to lie in the person. The mere co-occurrence (in space and time) of a positive (or negative) event and the person to be judged is enough to cause a cognitive bias that affects our judgments in impression formation.

The cause of these judgments lies in the associated valence, and not in accurate observations of the abilities of the target, therefore, I argue that the results of my experiments demonstrate a form of Cognitive Illusions. According to Pohl (2017), a Cognitive Illusion leads (1) to a perception or judgment that reliably deviates from an objective reality, and (2) this deviation has to be in a systematic fashion. They appear (3) involuntarily and are (4) hard to avoid and (5) stick out from the normal course of information processing.

Even though the true characteristics of the portrayed persons are unknown, and thus it is hard to argue that the judgments differ from the objective truth, I will still argue that they do. Because there is a systematic difference between the judgments for the very same portrayed person in dependence of the associated valence with that portrait person, the judgments have to derivate from the truth. When the same person gets two systematically different judgments, at least one judgment must differ from the truth.

But did the judgments appeared involuntarily and are hard to avoid? My data do not allow to answer this question directly. Past research on both, Evaluative Conditioning and halo effects have shown, however, that both effects can occur without participants deliberate will (Balas & Gawronski, 2012; Nisbett & Wilson, 1977). Because my experiments could be seen as a mixture of Evaluative Conditioning effects (valence effects) and halo effects (spread over effects), there is good reason to assume that the same is true for the valence illusion, even though this should be tested directly in future research.

For the last point, I argue that the found pattern does stick out from the normal course of information processing, because who would have thought that pairing a portrait of a person with a picture of a nice sunset would result in people believing that the portrait person is more intelligent? In a normal pattern of information processing, I would assume that people rely on observations of the to be judged ability itself, not on unrelated positive or negative events outside of the target person.

4.2 The role of correct recognitions

Is correct recognition a necessity for the found valence effects in impression formation? The data analyzed in this dissertation suggest that this is not the case. In two experiments, the correct recognition did not moderate the effect of US valence, and in the third experiment, it only did so marginally. For Experiment 1a, one could argue that the measure we used was not optimal, since almost all stimuli were recalled correctly, leaving too few data points in the non-recognized stimuli cell. This argument, however, was targeted directly by Experiment 1b, in which we doubled the amount of stimuli, resulting in more cases of not correctly identified stimuli. Still, the correct recognition did not moderate the EC effect. Taken together, these results suggest that participants did not need to identify the correct stimuli. While contingency awareness was identified as the most important moderator of EC effects in a meta-analysis, contingency unaware EC effects do occur (e. g., Hofmann et al., 2010). Even though we did not test participant's recognition of CS – US pairings (we only tested whether the portrayed person has been seen before), the results of our experiment do seem to point in the same direction.

4.3 Implications

The reported experiments opened the door for EC procedures to be used as an investigative tool for valence effects in impression formation. While most research on EC is devoted to questions about the underlying cognitive processes, this line of research offers new ways for both, EC researchers and researchers on impression formation, to explore.

The here demonstrated valence illusion has far reaching implications. It demonstrates that valence leads to a bias in judgments about others, and this bias may come into play whenever people need to be judged on different dimensions. Often people have to be selected for certain tasks, and this selection is often based on judgments about perceived personal characteristics of the target person. You might want to hire intelligent people if the job-vacancy that is to be filled is cognitive demanding. The valence illusion suggest that we are biased in the way we perceive the intelligence of a person, depending on the valence we associate with him or here. If you believe that your co-workers are more honest than workers at a different lab, than you might fall victim to the valence illusion, because you (hopefully) had some positive experiences with you co-workers, which biased the way you think about them. The interesting thing here is that past EC research suggests that the positive (or negative) experience with one person does not have to be of a causal nature. The mere co-occurrence in space and time of a valenced event with one person might be enough to trick us into the valence illusion.

4.4 Future research

Future research should focus on distinguishing the valence illusion from other spread over effects. As shown earlier, many halo effects seem to share the same valent direction, hence it would be interesting to test whether these halo effects really need a known starting point, like the beauty of a person in the what-is-beautiful-is-good effect. Because looking at beautiful persons is likely to be associated with positive valence, future research could test whether these effects really start with the given attribute, in this case beauty. It seems possible that beauty effects have its root in the valence associated with it, and the current work offers a direct way to test these possibilities. Future research should also further investigate the similarities of other attributes and likability. This way, the prediction of the size of the valence illusion could be more specific and extended to other areas.

One important avenue of future research lies in question on how to deal with the valence illusion. The valence illusion shows how inaccurate people are in judging others, yet when evaluating other persons, accuracy is very important. Researchers need to identify possible ways to deflect such a bias. Because both, EC effects and halo effects have been shown to be independent of participants being aware of the bias, people are likely to fall victim to these effects every day.

Boundaries of the valence illusion should be addressed. The first set of experiments showed that it is still unclear to what degree a stimulus can be changed and still be affected by the valence transfer, even though this question is very important for given answers on how far these effects go. What is the boundary distant for the similarity ratings towards likability? How distant can an attribute be to still be target of the valence illusion? Are their dimensions that produce even bigger effects then likability? Would that mean that there is a dimension even closer to valence itself? And would this dimension then be a better predictor for the size of the valence effect?

4.5 Limitations

Even though the valence illusion has been documented with a total of seven Experiments, there are still limitations worth to be mentioned.

First, even though the valence illusion hypothesis claims to be caused by valence, it has only been tested with EC procedures. Thus, even though unlikely, it is still a possibility that the found effects are unique in EC settings. One way to eliminate this limitation would be to use alternative methods of inducing valence effects, such as the mere exposure procedure.

Second, likability has been used as the dimension that comes closest to the latent construct valence. This has been derived from the literature of EC, in which likability is the standard measure of valence effects. Still, there is only indirect experimental evidence for such a claim. Thus, it might be possible that other dimensions are even closer to valence, and the valence illusion would then predict that these other dimensions would be a better predictor for the size of the valence effects.

Lastly, the valence illusion hypothesis claims to demonstrate a cognitive bias in everyday situations, but all experiments were taken in isolated labor settings. This was done for good reason, because labor settings allow the researcher to have full control over what is happing, and thus help to eliminate disturbing influences and alternative explanations. Still, whenever research claims to explain real world phenomena, the real test would come in real world settings. In the laboratory, valence and portrait photographs were the only pieces of information that participants got to form an impression. In the real world, people will have access to many more information about a person, accurate and inaccurate. Thus, it is unclear how resistant these valence effects are when competing with other pieces of information. This is, however, not a unique limitation of the valence illusion hypothesis, but applies to all research that has only been documented in laboratory settings.

4.6 Conclusion

The present dissertation argues that valence acts as a superordinate dimension in impression formation. This assumption was tested via EC, a procedure that has been said to manipulate isolated valence directly. First, it has been demonstrated that EC is a suitable procedure for the investigation of valence effects in impression formation, because it was shown that the valence effects caused by the EC procedure did not only affect the specific photograph that had been used in the conditioning phase. Valence transfer did happen even for those CSs that were altered by possible everyday changes in appearance of human beings, such as the addition or subtraction of glasses. Furthermore, valence did act as a superordinate dimension, influencing both, agentic and communal related characteristics. The size of this effect can be predicted by the conceptual similarity of the given characteristic with likability, which were measured by distances in a multidimensional space. This influence of valence on subordinate dimensions in impression formation has been labeled the valence illusion, because valence biased the judgments on perceived characteristics of photographed individuals.

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List of figures

List of tables

List of abbreviations

EC = Evaluative Conditioning

CS = Conditioned Stimulus

RR = Recognition Rates

SpAM = Spatial Arrangement Method

ToC = Type of Characteristics

US = Unconditioned Stimulus

VAC = Viewing Angle Change

Appendix A

Table 1

Results of Experiment 1a

	b	*se*	*t*	*p*
US Valence	4.73	1.11	4.27	< .001
VAC 45°	-0.35	1.56	-0.23	.82
VAC 90°	2.96	1.57	1.89	.06
RR	-1.14	1.62	-0.71	.48
Valence × VAC 45°	-1.26	1.58	-0.80	.43
Valence × VAC 90°	-1.72	1.57	-1.09	.27
Valence × RR	0.93	1.45	0.64	.52
VAC 45° × RR	2.12	1.91	1.11	.27
VAC 90° × RR	2.38	1.75	1.37	.17
Valence × VAC 45° × RR	1.61	1.89	0.85	.40
Valence × VAC 90° × RR	0.32	1.72	0.18	.85

Note: Relationships of US Valence, Viewing Angle Change (VAC), and Recognition Ratings (RR) on a trial by trial basis.

Table 2

Results of Experiment 1b

	b	*se*	*t*	*p*
US Valence	1.46	0.76	1.91	.06
VAC 45°	1.80	1.08	1.66	.10
VAC 90°	-0.47	1.07	-0.43	.66
RR	2.44	0.88	2.79	< .01
Valence × VAC 45°	0.36	1.08	0.33	.74
Valence × VAC 90°	-0.47	1.07	-0.44	.66
Valence × RR	0.34	0.85	0.40	.69
VAC 45° × RR	-1.33	1.11	-1.19	.23
VAC 90° × RR	-1.86	1.15	-1.62	.11
Valence × VAC 45° × RR	-0.44	1.11	-0.40	.69
Valence × VAC 90° × RR	-0.21	1.14	-0.18	.85

Note: Relationships of US Valence, Viewing Angle Change (VAC), and Recognition Ratings (RR) on a trial by trial basis.

Table 3

Results of Experiment 1c

	b	*se*	*t*	*p*
US Valence	3.15	0.97	3.25	< .01
CS FC	0.07	0.68	0.11	.91
RR	-0.79	0.76	-1.04	.30
Valence × CS FC	0.36	0.97	-0.38	.71
Valence × RR	-1.75	1.03	-1.70	.09
CS FC × RR	0.28	0.73	0.38	.70
Valence × CS FC × RR	-0.84	1.02	-0.82	.41

Note: Relationships of US Valence, CS Feature Change (CS FC), and Recognition Ratings (RR) on a trial by trial basis.

Table 4

Results of Experiment 2a: Attributes

Attribute	*b*	*se*	*t*	*p*
Agency				
Competency	4.95	0.82	6.06	< .001
Efficiency	2.05	0.76	2.72	< .01
Full of energy	4.48	0.86	5.22	< .001
Intelligence	2.39	0.71	3.37	< .001
Respectability	3.74	0.83	4.50	<. 001
Communion				
Fairness	6.74	0.81	8.30	< .001
Honesty	7.16	0.87	8.27	< .001
Likability	6.76	0.90	7.48	< .001
Loyalty	6.87	0.87	7.89	< .001
Sincerity	6.56	0.82	7.99	< .001

Note: Relationships of US valence and Attributes on a trial by trial basis.

Table 5

Results of Experiment 2a: Grand Analysis

Attribute	*b*	*se*	*t*	*p*
US Valence	3.53	0.69	5.12	< .001
ToC	-3.40	0.98	-3.48	< .001
US Valence × ToC	3.25	0.98	3.33	< .001

Note: Relationships of US Valence and Type of Characteristics (ToC) on a trial by trial basis.

Table 6

Results of Experiment 2b: Attributes

Attribute	*b*	*se*	*t*	*p*
Agency				
Competency	2.28	0.70	3.27	< .01
Efficiency	1.84	0.67	2.74	< .01
Full of energy	1.41	0.80	1.75	.08
Intelligence	1.87	0.65	2.87	< .01
Respectability	2.21	0.70	3.15	<. 01
Communion				
Fairness	3.24	0.75	4.33	< .001
Honesty	2.63	0.77	3.41	< .001
Likability	1.77	0.83	2.12	< .05
Loyalty	1.05	0.78	1.35	.18
Sincerity	1.75	0.76	2.29	< .05

Note: Relationships of US valence and Attributes on a trial by trial basis.

Table 7

Results of Experiment 2b: Grand Analysis

Attribute	*b*	*se*	*t*	*p*
US Valence	1.99	0.61	3.28	< .01
ToC	-3.03	0.86	-3.25	< .001
US Valence × ToC	0.02	0.86	0.03	.98

Note: Relationships of US Valence and Type of Characteristics (ToC) on a trial by trial basis.

Table 8

Results of Experiment 2c: Attributes

Attribute	*b*	*se*	*t*	*p*
Agency				
Competency	2.46	2.70	3.58	< .01
Efficiency	1.44	0.51	2.84	< .01
Full of energy	2.15	0.56	3.84	< .001
Intelligence	1.36	0.50	2.70	< .01
Respectability	2.69	0.53	5.06	<. 001
Communion				
Fairness	4.66	0.59	7.86	< .001
Honesty	4.15	0.59	7.03	< .001
Likability	4.10	0.59	6.89	< .001
Loyalty	3.72	0.59	6.32	< .001
Sincerity	4.98	0.58	8.53	< .001

Note: Relationships of US valence and Attributes on a trial by trial basis.

Table 9

Results of Experiment 2c: Grand Analysis

Attribute	*b*	*se*	*t*	*p*
US Valence	3.18	0.33	9.68	< .001
ToC	-1.43	0.33	-4.35	< .001
US Material	0.52	0.73	0.72	.47
US Valence × ToC	1.16	0.33	3.54	< .001
US Valence × US Material	-0.60	0.33	1.82	.07
ToC × US Material	0.66	0.33	2.02	< .05
US Valence × ToC × US Material	-0.45	0.33	-1.36	.17

Note: Relationships of US Valence, Type of Characteristics (ToC), and US Material on a trial by trial basis.

Table 10

Results of Experiment 2d: Attributes

Attribute	*b*	*se*	*t*	*p*
Agency				
Competency	3.28	0.53	6.25	< .001
Efficiency	2.61	0.51	5.17	< .001
Full of energy	3.01	0.58	5.23	< .001
Intelligence	2.82	0.49	5.78	< .001
Respectability	2.80	0.53	5.31	<. 001
Communion				
Fairness	5.38	0.58	9.30	< .001
Honesty	5.45	0.57	9.57	< .001
Likability	5.45	0.63	8.86	< .001
Loyalty	5.47	0.58	9.52	< .001
Sincerity	5.18	0.56	9.25	< .001

Note: Relationships of US valence and Attributes on a trial by trial basis.

Table 11

Results of Experiment 2d: Grand Analysis

Attribute	*b*	*se*	*t*	*p*
US Valence	2.92	0.46	6.35	< .001
ToC	-2.89	0.65	-4.45	< .001
US Valence × ToC	2.45	0.65	3.77	< .001

Note: Relationships of US Valence and Type of Characteristics (ToC) on a trial by trial basis.

Table 12

Spatial Distances

Agency	Distance	Communion	Distance
Competency	468	Fairness	283
Efficiency	547	Honesty	354
Full of energy	480	Loyalty	315
Intelligence	493	Sincerity	290
Respectability	305		
Mean	465	Mean	310

Note: Distance = Euclidean distance from any given attribute towards likability in pixels. All values represent mean values on a group level.

Appendix B

Items Experiments 1a – 1c

Scale ranging from 0 (sehr unangenehm) to 100 (sehr angenehm)

Bitte geben Sie für jede Person an, wie angenehm oder unangenehm Sie die abgebildete Person finden! Uns interessiert Ihr spontaner Eindruck.

Scale: Yes or No

Haben Sie diese Person in der vorangegangenen Wahrnehmungsphase gesehen?

Items Experiments 2a – 2d

Scale ranging from -50 to 50

Die abgebildete Person ist kompetent

Die abgebildete Person ist effizient

Die abgebildete Person ist voller Energie

Die abgebildete Person ist intelligent

Ich habe vor der abgebildeten Person Respekt

Die abgebildete Person ist fair anderen gegenüber

Die abgebildete Person ist ehrlich

Die abgebildete Person ist loyal

Die abgebildete Person ist aufrichtig

Ich mag die abgebildete Person

Appendix C

All statistical analyses were performed with RStudio (1.0.153). All linear models were analyzed using the lmer() function from lme4 package (Bates, Maechler, & Boker, 2011). The following commands were used to fit the initial models:

```
> library (lme4)
> model_1 < lmer(y ~ c + (1 | j) + (c | i), data =dat)
```